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**Subject: Expanded Phase II Sampling and Analysis Plan (SAP)
East Troy Contaminated Aquifer (East Troy) Site
Remedial Investigation/Feasibility Study (RI/FS); Troy, Ohio
Work Assignment No. 145-RICO-B5EN**

Dear Ms. Kolak:

SulTRAC is submitting an electronic copy of the expanded Phase II SAP for your review. This expanded Phase II SAP supplements the Phase I SAP and Vapor Intrusion Monitoring Program SAP addendum previously approved by EPA.

If you have any questions regarding this submittal, please call me at (513) 333-3669.

Sincerely,

A handwritten signature in black ink, appearing to read "Guy D. Montfort".

Guy Montfort
SulTRAC Project Manager

Enclosure

cc: Parveen Vij, EPA Contracting Officer (letter only)
 Melinda Gould, SulTRAC Program Manager (letter only)
 File

**EXPANDED PHASE II SAMPLING AND ANALYSIS PLAN
EAST TROY CONTAMINATED AQUIFER SITE
TROY, OHIO**

SulTRAC has prepared this expanded Phase II remedial investigation (RI) sampling and analysis plan (SAP) to supplement the Phase I SAP and Vapor Intrusion Monitoring Program SAP addendum for the East Troy Contaminated Aquifer Site (East Troy site) in Troy, Miami County, Ohio. This SAP was prepared under the U.S. Environmental Protection Agency (EPA) Remedial Action Contract (RAC) II for Region 5, Contract No. EP-S5-06-02, Work Assignment (WA) No. 145-RICO-B5EN.

Data gathered during the Phase I and initial Phase II investigations were used to develop an approach for the expanded Phase II RI. Expanded Phase II RI activities include: (1) further characterizing potential source areas to delineate the extent of contamination and facilitate evaluation of remedial alternatives in the feasibility study (FS), (2) obtaining indoor air samples at suspected source areas not previously sampled in Phases I or II, (3) evaluating potential secondary source areas within groundwater plume hot spots that may be associated with contaminants sorbed to fine-grained materials, and (4) filling other data gaps identified during the Phase II RI. The complete scope of the expanded Phase II field investigation is presented in this SAP; however, specific protocols and objectives, methods, and procedures for investigation activities detailed in previous East Troy site SAPs are not presented in this report. Instead, the Phase I SAP and Vapor Intrusion Monitoring Program SAP addendum are referenced where appropriate.

As requested in EPA's statement of work (SOW) for the site, SulTRAC has prepared this SAP comprised of two parts: the field sampling plan (FSP) is provided in Attachment A and the quality assurance project plan (QAPP) is provided in Attachment B.

**REMEDIAL ACTION CONTRACT 2
FOR REMEDIAL, ENFORCEMENT OVERSIGHT, AND
NON-TIME CRITICAL REMOVAL ACTIVITIES
IN REGION 5**

**EXPANDED PHASE II FIELD SAMPLING PLAN
EAST TROY CONTAMINATED AQUIFER SITE
TROY, MIAMI COUNTY, OHIO**

(REVISION 0)

**Prepared for
United States Environmental Protection Agency
Region 5
77 West Jackson Boulevard
Chicago, IL 60604**

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CONTENTS

<u>Section</u>	<u>Page</u>
ACRONYMS AND ABBREVIATIONS	iii
1.0 INTRODUCTION	1
1.1 PURPOSE OF EXPANDED PHASE II RI SAP ADDENDUM	1
1.2 SUMMARY OF PHASE I AND PHASE II INVESTIGATIONS TO DATE	2
1.3 GENERAL SCOPE OF PROPOSED EXPANDED PHASE II INVESTIGATION ACTIVITIES	3
2.0 SITE DESCRIPTION AND HISTORY	6
2.1 FORMER DRY CLEANER AT 10 EAST MAIN STREET	7
2.2 FORMER DRY CLEANER AT 432 EAST MAIN STREET	7
2.3 FRANKLIN AND CLAY STREET AREA	8
2.4 HOBART CABINET COMPANY	8
2.5 SPINNAKER COATING PROPERTY	9
2.6 AREA SOUTHEAST OF SPINNAKER	11
2.7 OTHER AREAS OF INVESTIGATION	11
2.8 SUMMARY AND DATA GAPS	12
3.0 FIELD SAMPLING ACTIVITY	13
3.1 HRSC GROUNDWATER PROFILING	13
3.2 SOIL SAMPLING	16
3.3 SUB-SLAB SOIL VAPOR AND INDOOR AIR SAMPLING	19
3.4 SURFACE WATER AND SEDIMENT SAMPLING	21
3.5 HYDROGEOLOGIC INVESTIGATION AND GROUNDWATER SAMPLING – VOCs	21
3.6 REMEDIATION PARAMETERS	22
3.7 GENERAL SAMPLING CONSIDERATIONS	25
3.8 DECONTAMINATION PROCEDURES	26
3.9 SAMPLE HANDLING PROCEDURES	26
3.10 SAMPLE IDENTIFICATION	30
3.11 INVESTIGATION-DERIVED WASTE AND HEALTH AND SAFETY	32
3.12 QUALITY ASSURANCE/QUALITY CONTROL REQUIREMENTS	33
4.0 REFERENCES	35

TABLES

<u>Table</u>		<u>Page</u>
1	HRSC GROUNDWATER PROFILING SUMMARY	15
2	SOIL SAMPLING SUMMARY	18
3	SUMMARY OF SUB-SLAB AND INDOOR AIR SAMPLING	19
4	SCREENING LEVELS FOR VAPOR INTRUSION MONITORING	20
5	SUMMARY OF GROUNDWATER REMEDIATION PARAMETERS	24
6	SUMMARY OF SOIL REMEDIATION PARAMETERS	25
7	ANALYTICAL METHODS SUMMARY	27
8	SAMPLE CONTAINER, PRESERVATION, AND HOLDING TIMES	28
9	GENERALIZED SAMPLE IDENTIFICATION SCHEME	31

FIGURES

1	SITE LOCATION AND KNOWN OR SUSPECTED SOURCE AREAS
2	GROUNDWATER PLUME AREAS AND SHALLOW GROUNDWATER SAMPLING LOCATIONS
3	10 EAST MAIN AND GROUNDWATER PLUME INVESTIGATION AREAS, RI PHASE I & II GROUNDWATER AND SOIL SAMPLING RESULTS
4	432 EAST MAIN INVESTIGATION AREA, RI PHASE I & II GROUNDWATER AND SOIL SAMPLING RESULTS
5	HOBART INVESTIGATION AREA, RI PHASE I & II GROUNDWATER AND SOIL SAMPLING RESULTS
6	SPINNAKER INVESTIGATION AREA, RI PHASE I & II GROUNDWATER AND SOIL SAMPLING RESULTS
7	RI PHASE II GROUNDWATER SAMPLING RESULTS
8	10 EAST MAIN AND GROUNDWATER PLUME INVESTIGATION AREAS, RI PHASE I & II GROUNDWATER AND SOIL SAMPLING RESULTS AND EXPANDED PHASE II SAMPLING LOCATIONS
9	432 EAST MAIN INVESTIGATION AREA, RI PHASE I & II GROUNDWATER AND SOIL SAMPLING RESULTS AND EXPANDED PHASE II SAMPLING LOCATIONS
10	HOBART INVESTIGATION AREA, RI PHASE I & II GROUNDWATER AND SOIL SAMPLING RESULTS AND EXPANDED PHASE II SAMPLING LOCATIONS
11	SPINNAKER INVESTIGATION AREA, RI PHASE I & II GROUNDWATER AND SOIL SAMPLING RESULTS AND EXPANDED PHASE II SAMPLING LOCATIONS
12	RI PHASE II GROUNDWATER SAMPLING RESULTS AND EXPANDED PHASE II SAMPLING LOCATIONS

ACRONYMS AND ABBREVIATIONS

µg/L	Micrograms per liter
µm	Micrometer
µg/m ³	Micrograms per cubic meter
ASTM	American Society for Testing and Materials (now ASTM International)
bgs	Below ground surface
BTEX	Benzene, toluene, ethylbenzene, and xylene
°C	Degrees Celsius
CLP	Contract Laboratory Program
COC	Chain of custody
CRL	Central Regional Laboratory
DCA	Dichloroethane
DCE	Dichloroethene
EPA	U.S. Environmental Protection Agency
FS	Feasibility study
FSP	Field sampling plan
ft	Feet
GC/MS	Gas chromatography/mass spectrometry
GPS	Global positioning system
H ₂ SO ₄	Sulfuric acid
HASP	Health and safety plan
HCl	Hydrochloric acid
HDPE	High-density polyethylene
HRSC	High-resolution site characterization
ID	Identification
IDW	Investigation-derived waste
K-C	Kimberly-Clark, Inc.
MCD	Miami Conservancy District
MCL	Maximum contaminant level
MIP	Membrane interface probe
mg/kg	Milligrams per kilogram
mL	Milliliter
MS	Matrix spike
MSD	Matrix spike duplicate

ACRONYMS AND ABBREVIATIONS (CONTINUED)

ND	None detected
NR	Not required
ODH	Ohio Department of Health
Ohio EPA	Ohio Environmental Protection Agency
ORP	Oxidation reduction potential
PCE	Tetrachloroethene
PTFE	Polytetrafluoroethene
PID	Photoionization detector
PPE	Personal protective equipment
QA	Quality assurance
QAPP	Quality assurance project plan
QC	Quality control
RAC	Remedial action contract
RI	Remedial investigation
ROD	Record of Decision
RP	Remediation parameter
SAP	Sampling and analysis plan
SIM	Selective ion method
SM	Standard Methods for the Examination of Water and Wastewater
SOW	Statement of work
TCA	Trichloroethane
TCE	Trichloroethene
TCL	Target compound list
TDS	Total dissolved solids
VAS	Vertical aquifer sampling
VI	Vapor intrusion
VISL	Vapor intrusion screening level
VOC	Volatile organic compound
WA	Work assignment

1.0 INTRODUCTION

SulTRAC has prepared this expanded Phase II field sampling plan (FSP) as part of the sampling and analysis plan (SAP) to supplement the Phase I SAP and Vapor Intrusion Monitoring Program SAP addendum for the East Troy Contaminated Aquifer Site (East Troy site) in Troy, Miami County, Ohio (see Figure 1) (SulTRAC 2010a, 2011b). This FSP was prepared under the U.S. Environmental Protection Agency (EPA) Remedial Action Contract (RAC) II for Region 5, Contract No. EP-S5-06-02, Work Assignment (WA) No. 145-RICO-B5EN. A remedial investigation (RI)/feasibility study (FS) is being conducted at the East Troy site. The RI/FS is investigating the nature and extent of contamination in soil, subsurface gas, indoor air, groundwater, sediment, and surface water; and the threat this contamination poses to human health and the environment. The RI/FS will generate sufficient data to allow selection of an approach for remediation that eliminates, reduces, or controls risks to human health and the environment posed by the site as well as to support a Record of Decision (ROD) (EPA 2009, 2011; SulTRAC 2009, 2010a, 2011a, 2011b). The RI/FS is being conducted in two phases. Data gathered during the Phase I and initial Phase II investigations were used to develop an approach for the expanded Phase II RI that will address additional field investigations that focus primarily on source area characterization.

The SAP consists of this FSP (Attachment A of the SAP), and the quality assurance project plan (QAPP) (Attachment B of the SAP), which are among the site-specific plans that have been prepared under WA No. 145-RICO-B5EN, in accordance with Task 1 in the EPA statement of work (SOW) (EPA 2011).

1.1 PURPOSE OF EXPANDED PHASE II RI SAP ADDENDUM

The East Troy RI/FS Phase I SAP was submitted to EPA in August 2010 and consists of two components: the FSP and the QAPP (SulTRAC 2010a). The Phase I FSP presented sampling and analytical procedures for all Phase I activities, with the exception of procedures to evaluate concentrations of volatile organic compounds (VOC) at the actual points of exposure for the vapor intrusion (VI) pathway. Procedures for monitoring sub-slab vapor and indoor air to support the evaluation of the VI pathway were presented in the Vapor Intrusion Monitoring Program SAP addendum (SulTRAC 2011b). The Phase I SAP and Vapor Intrusion Monitoring Program SAP Addendum for the East Troy site were approved by EPA in 2010 and 2011, and these documents addressed the objectives and methods for all sampling and analysis completed during Phases I and II of the RI at the East Troy site to date (SulTRAC 2010a, 2011b). Field activities addressed by these documents and completed to support Phases I and II of the RI have included drilling, installing monitoring wells, completing soil borings, measuring groundwater elevations,

and sampling and analysis of various media including soils, groundwater, sub-slab vapor and indoor air, surface water, and sediment.

Data collected during the RI to date were summarized in two technical memoranda (SulTRAC 2013a, 2013b). Based on the data collected to date, EPA concluded that additional site characterization data are needed to complete Phase II of the RI. SulTRAC has prepared this expanded Phase II SAP addendum to specifically address the objectives and methods for additional site characterization to be conducted in the expanded Phase II field investigation.

The first portion of the expanded Phase II investigation includes an initial screening investigation using a membrane interface probe (MIP). The scope and procedures of the MIP investigation are detailed in a MIP investigation sampling plan (SulTRAC 2013c). MIP is a high resolution site characterization (HRSC) technique that will be used to obtain a higher density of screening-level data at the suspected source areas. The investigation using real-time MIP technology will be completed first and used in part to identify lateral and vertical locations potentially requiring further investigation. As a result, the results of the MIP investigation will likely alter the number and locations of soil and groundwater samples collected as part of this expanded Phase II RI. Therefore, the sample numbers and locations presented in this SAP are estimates, and actual numbers and locations may vary.

The further (post-MIP) Phase II investigation activities and procedures are addressed in this SAP addendum. Expanded Phase II RI activities include: (1) further characterizing potential source areas to delineate the extent of contamination and facilitate evaluation of remedial alternatives in the FS, (2) obtaining indoor air samples at suspected source areas not previously sampled in Phases I or II, (3) evaluating potential secondary source areas within hot spots in the groundwater plume that may be associated with contaminants sorbed to fine-grained materials, and (4) filling other data gaps identified during the Phase II RI.

1.2 SUMMARY OF PHASE I AND PHASE II INVESTIGATIONS TO DATE

Phase I field activities were initiated in the summer of 2010 and included a baseline groundwater sampling event and sediment and surface water sampling in the Great Miami River. Phase I activities resumed in the fall of 2011 and included a camera investigation of the sanitary sewer system; drilling and installing groundwater monitoring wells; completing soil borings with soil and groundwater sampling; a vertical aquifer sampling (VAS) program; a comprehensive groundwater sampling event to include all

existing and new monitoring wells; and a VI monitoring program. Phase I activities were completed in June 2012.

Initial Phase II RI activities were conducted in accordance with the approved Phase I SAP and the Vapor Intrusion Monitoring Program SAP addendum. Initial Phase II activities were initiated in August 2012 and concluded in April 2013. Initial Phase II activities included resampling of some Phase I vapor intrusion sampling locations, collecting groundwater screening samples, collecting groundwater elevation measurements, installing additional VAS and monitoring wells, a second comprehensive groundwater sampling event, collecting soil samples and shallow groundwater screening samples, and additional VI sampling. In addition, a site visit focused on evaluating potential source areas was conducted in July 2013.

Data collected during the RI to date were summarized in two technical memoranda (SulTRAC 2013a, 2013b). The data collected have provided extensive information on the nature and extent of contamination at the site as well as site geology and hydrogeology and identified the areas (referred to as “potential source areas”) where the groundwater contaminant plumes may have originated. Based on the results of Phases I and II to date, EPA and Ohio EPA have concluded that additional information is needed (1) to investigate the original potential sources of the contamination, (2) to evaluate the potential presence and nature of residual contamination or “secondary sources” that may be contributing to the ongoing presence of the groundwater contaminant plumes at the East Troy site; and, (3) to gather the information needed to support the evaluation of general and specific potential remedial alternatives for the contamination at the East Troy site.

1.3 GENERAL SCOPE OF PROPOSED EXPANDED PHASE II INVESTIGATION ACTIVITIES

The scope of work for the expanded Phase II investigation was developed to provide the additional data regarding potential contaminant sources at the East Troy site and that may support identification and evaluation of potential remedial alternatives in the FS. The expanded Phase II investigation will use real-time field methods to optimize sample collection and site characterization in the potential source areas that were identified during Phase I and Phase II to date. Therefore, the overall approach is to select initial sampling locations based on Phase I and II results and allow for the flexibility to step out from initial locations, as necessary.

The expanded Phase II investigation will include activities and analyses that were addressed by the previously approved SAP and SAP addendum (SulTRAC 2010a, 2011b) and have been employed during

the Phase I and II investigations to date. In addition, the expanded Phase II will employ investigative techniques and analyses not previously used to support this RI and not addressed in the previous site-specific planning documents. This expanded Phase II SAP addendum addresses the following specific field activities and analysis to be conducted at the East Troy site that are not covered in the previously submitted SAP and SAP addendum:

- HRSC direct-push, multilevel, groundwater profiling – Based on MIP results, SulTRAC will conduct multiple transects using HRSC groundwater profiling to identify primary and secondary source areas at each of the potential source areas assessed during the July 2 and 3, 2013, site visit. Groundwater samples collected will be analyzed for target VOCs (tetrachloroethene [PCE], trichloroethene [TCE], cis-1,2-dichloroethene [cis-1,2-DCE], 1,1,1-trichloroethane [1,1,1-TCA], 1,1,2-TCA, dichloroethane [DCA], vinyl chloride, and benzene, toluene, ethylbenzene, and xylene [BTEX]) using a mobile laboratory for fast turnaround. Mobile laboratory results may be used to guide or modify subsequent sampling locations.
- Remediation Parameters – Soil and groundwater samples will be collected to facilitate evaluation of remedial alternatives in the FS. Soil parameters will evaluate the potential effectiveness of in situ remediation technologies in saturated and unsaturated zones. Soil remediation parameters include total organic carbon, grain size and particle size distribution, hydraulic conductivity, soil permeability, bulk soil density, and porosity. Groundwater remediation parameters will be used to evaluate the effectiveness of natural attenuation and other in situ remediation technologies. Groundwater remediation parameters include anions (chloride, sulfate, nitrate, fluoride, and bromide), ferrous iron, dissolved gases (methane, ethane, and ethene), total organic carbon, alkalinity, and total dissolved solids. In addition, the following groundwater field parameters will be collected from each well where remediation parameter sampling will be conducted: temperature, pH, specific conductance, dissolved oxygen, and oxidation reduction potential (ORP).

Expanded Phase II activities and analyses that have been addressed in previously submitted SAPs include:

- Additional soil sampling – SulTRAC will complete additional soil sampling with analysis for VOCs at locations in or near the potential source areas. Samples will be collected using direct-push methods or as surface grab samples and submitted for analysis for VOCs via the EPA Contract Laboratory Program (CLP).
- Groundwater sampling – SulTRAC will install at least one additional permanent monitoring well to confirm the downgradient limit of the residential area VOC plume in the vicinity of Floral Avenue. (Should the MIP or HRSC work indicate a potential need for additional monitoring wells, additional wells may be installed.) SulTRAC will collect samples from any newly installed wells and eight monitoring wells where groundwater samples will be collected for remediation parameters; these samples will be analyzed for VOCs to provide data regarding variations in plume concentrations over time and to support decisions regarding the scope of various remedial alternatives that will be considered during the FS. Groundwater samples will also be collected from the eight groundwater remediation parameter sampling locations for analysis of VOCs.
- Vapor Intrusion Monitoring – Additional VI monitoring will be attempted at various locations (contingent on access) to meet the following objectives (1) to support evaluation of potential source areas covered by structures that limit access to drilling equipment, and (2) to support the

evaluation of human health risk for the VI pathway. EPA has been granted access to and conducted VI sampling at 108 residential and commercial structures located in areas that overlie the suspected source areas or groundwater contaminant plumes since 2006. EPA has requested access to conduct sampling at most other structures in these areas; however, access was not granted at some locations, and owners of many other locations were nonresponsive to EPA's requests. Ownership of some properties where access was denied may have changed since access was last requested by EPA, and additional VI monitoring may provide data regarding potential source area characterization.

- Surface water and sediment (if sediment is present) samples will be collected from the Great Miami River to evaluate the potential that contaminated groundwater is discharging to the river downstream from the previously sampled locations

Additional expanded Phase II activities such as general site reconnaissance activities (including documentation of private irrigation well use), collecting groundwater elevation measurements, and ground surface elevation surveys will also be conducted in accordance with the procedures and methods described in the Phase I SAP (SulTRAC 2010a). In addition, all newly installed groundwater monitoring wells will be installed, developed, and sampled in accordance with the procedures and methods described in the Phase I SAP (SulTRAC 2010a).

All groundwater samples obtained during HRSC groundwater profiling will be analyzed by a mobile laboratory for target VOCs. Groundwater (collected from new and existing monitoring wells), soil, sediment, and surface water samples will be submitted to an EPA CLP laboratory for Target Compound List (TCL) VOC analysis. Indoor air, sub-slab vapor, and ambient air samples will be analyzed by a subcontracted laboratory. Select soil samples to be analyzed for remediation parameters will be analyzed by a subcontracted laboratory. Select groundwater samples will be analyzed for remediation parameters by TestAmerica, Inc. in Canton, Ohio.

When the expanded Phase II RI is complete, the draft RI report will be prepared describing all RI activities and results.

2.0 SITE DESCRIPTION AND HISTORY

Detailed descriptions of the East Troy site characteristics, history, and previous investigations are presented in the RI/FS Phase I SAP (SulTRAC 2010a). Additionally, summaries of the Phase I and II investigation results are presented in the Phase I and II technical memoranda (SulTRAC 2013a, 2013b). Results of the Phase I and II investigations indicated that at least two groundwater contaminant plumes that originated from different sources exist, and these plumes appear to comeingle at some point (see Figure 2). The plumes are generally referred to as the residential area plume (originating near the intersection of Walnut and Main Streets) and the Water Street plume (originating at the Hobart Cabinet Company [Hobart] property). In addition, Phase I and Phase II data suggest that other source areas may lie within the footprint of the plumes and may also be contributing to the contamination. The potential source areas where the plumes appear to originate will be investigated further during the expanded Phase II activities, and additional potential contributing source areas identified to date will also be investigated. Areas to be investigated during the expanded Phase II activities include:

Residential Area Plume

- The area in the vicinity of the former “One Hour Martinizing” dry cleaner store that was located at 10 East Main Street and an area directly across Walnut Street containing high concentrations of VOCs near monitoring well EPA-MW-107I.
- The area adjacent to a second former dry cleaner location (Waltz Cleaners) at 432 East Main Street.
- Potential secondary source area near the intersection of Franklin and Clay Streets.

Water Street Plume

- Areas within the Hobart property.
- Areas within the Spinnaker Coating, LLC (Spinnaker), property.
- Along the Great Miami River bank southeast of the Spinnaker property.

Other Areas of Investigation

- Surface water and sediment from the Great Miami River.
- Groundwater and soil remediation parameter sampling locations to facilitate evaluation of remedial alternatives in the feasibility study.
- Groundwater elevation measurements at new and existing monitoring wells.
- Elevation surveys at new and up to 20 existing Spinnaker monitoring wells.
- Survey residents regarding private well use because of anecdotal evidence of residents using hand-dug wells for irrigation.

Aspects of the site history and Phase I and II investigation results relevant to each of the expanded Phase II investigation areas are summarized below.

2.1 FORMER DRY CLEANER AT 10 EAST MAIN STREET

During the Phase I and II investigations, soil and groundwater samples were collected in the area near the former location of a dry cleaner that reportedly operated in the period approximately between the late 1950s and 1980s at 10 East Main Street (see Figure 3). The residential area groundwater plume appears to originate at this potential source location. Phase I and II analytical results for groundwater indicate that the highest concentrations of PCE in this area were detected in groundwater samples from boring WAL-1 (186 micrograms per liter [$\mu\text{g/L}$]) on the west side of South Walnut Street, boring MAI-1 (330 $\mu\text{g/L}$) east of South Walnut Street on East Main Street, and from monitoring wells OEPA-11 (710 $\mu\text{g/L}$), and EPA-107I (2,200 $\mu\text{g/L}$). The building that housed the former dry cleaner and the adjacent structure to the east at 12 East Main were reportedly demolished to make room for the addition to the First Presbyterian Church constructed in the 1990s. The original structure at 10 East Main reportedly had no basement. The basement floor of the present structure sits approximately 6 to 7 feet below sidewalk level, indicating that at least the uppermost 7 feet of soil was excavated and removed during construction of the church addition. No additional source areas were identified during the recent site reconnaissance on July 2 and 3, 2013. The current church building covers the entire footprints of both the former dry cleaner facility and the former adjacent building to the east (immediately downgradient); therefore, no areas accessible for soil sampling were identified. A narrow grass-covered area is present in the area along Walnut Street between the church and the sidewalk. In addition, indoor air and sub-slab soil gas indoor air or soil gas samples were not collected at 10 East Main Street during Phase I or the initial Phase II because of access restrictions.

2.2 FORMER DRY CLEANER AT 432 EAST MAIN STREET

A dry cleaner (Waltz Cleaners) reportedly operated at 432 East Main Street until the early 2000s. This address includes three connected additions located along South Union Street behind the main building. During the Phase I and II investigations, groundwater samples were collected from monitoring wells both upgradient and directly adjacent to and downgradient of 432 East Main Street (see Figure 4) and from several other Geoprobe borings in this area. Results from the Phase II groundwater sample collected at well EPA-103S indicate PCE present at a concentration of 19 $\mu\text{g/L}$. PCE was not detected in groundwater samples collected in the apparent upgradient direction from this building. For this reason, this area may represent a separate, distinct PCE source area from the potential source area for the main residential area PCE plume. During the site reconnaissance on July 2 and 3, 2013, exhaust fans, vents, and an abandoned floor drain were observed in the structures associated with 432 East Main Street. Open grass areas exist near the exhaust fans on the west side of the building and along Union Street. The floor

drains that were observed in a portion of the building could have been used as part of the former dry cleaner operations.

Indoor air or soil gas samples were not collected at 432 East Main Street during Phase I or the initial Phase II because of access restrictions.

2.3 FRANKLIN AND CLAY STREET AREA

Groundwater samples collected in the vicinity of the intersections of Clay and Crawford Streets with East Franklin Street have consistently exhibited some of the highest PCE levels detected in the residential area plume since Ohio EPA first collected samples in this area in 2000 (see Figure 3). Samples collected from monitoring wells OEPA-7 (Franklin and Clay), and OEPA-1 and OEPA-6 (Crawford and Franklin) consistently exhibit PCE concentrations in the hundreds of $\mu\text{g/L}$.

PCE has also been detected in soil samples collected in this area; however, concentrations detected were relatively low. PCE was detected in soil samples at borings FRA-3 and FRA-4. PCE concentrations ranged from 6.2 to 23 milligrams per kilogram (mg/kg) in the soil samples collected at these locations. PCE and TCE were detected in groundwater samples collected in this area; however, PCE was detected at higher concentrations than TCE. PCE was detected in Phase I grab groundwater samples FRA-3 and FRA-4 at concentrations of 155 and 142 $\mu\text{g/L}$, as well as at a concentration of 510 $\mu\text{g/L}$ at well OEPA-7. In Phase II, PCE was detected at a concentration of 660 $\mu\text{g/L}$ at well OEPA-7. Additionally, downgradient wells OEPA-1 and OEPA-6 contained PCE at concentrations ranging from 350 to 650 $\mu\text{g/L}$ in Phase I and II.

No historical primary sources of the contamination have been identified in this area and, therefore, the contamination is currently believed to have originated at the main suspected source that was located near Walnut and Main Streets. However, this area may represent a concentrated area of contamination that is acting as a “secondary” source area feeding the PCE plume in the residential area.

2.4 HOBART CABINET COMPANY

During the Phase I and II investigations, soil and groundwater samples were collected at and near the Hobart property (see Figure 5). Significant concentrations of chlorinated solvents and associated daughter products (PCE, TCE, and DCE) and other VOCs (benzene, ethylbenzene, and xylene) were detected at soil borings HOB3, SB002, and SB003 near the loading dock at Hobart during the Phase I and II investigations. Soil contamination was detected in both shallow (1 to 4 feet below ground surface

[bgs]) and deep (10 to 12 feet bgs) soil, indicating that surface disposal or spillage likely occurred; however, no specific sources have been identified. In addition, lower levels of PCE, TCE, and benzene were detected in soil samples from boring HOB5, located in front of the building near the former location of the vapor degreaser. Phase II analytical results for groundwater indicated that PCE and TCE were detected in groundwater samples from shallow monitoring well OEPA-12 at concentrations of 42 and 50 µg/L. The Water Street plume appears to originate from this potential source area because VOCs were not detected in upgradient wells EPA-122S and OEPA-13. VOCs have not been detected in a deep monitoring well (MW-EPA-109D) located on the Hobart property.

Hobart's manufacturing process formerly employed a vapor degreaser that was located in the front of the building near Water Street, which used PCE to clean metal parts. Approximately 4 years ago, Hobart removed the degreaser and no longer uses chlorinated solvents for its present operations. The vapor degreaser sat partially below the present floor surface of the Hobart main plant floor level. When the degreaser was removed, a new section of floor slab was poured to cover the former degreaser area. During the site reconnaissance on July 2 and 3, 2013, the former degreaser area was observed to be paved over with relatively new concrete.

The Hobart building main floor is concrete atop a series of masonry footer walls that span the entire main structure. The building was reportedly constructed on the foundations a warehouse that formerly occupied the site. The present building has a partial basement located in the rear of the building. No evidence of historical manufacturing activities was noted in the basement. PCE was reportedly brought in to the building on the main plant floor level in drums by way of the loading dock behind the building. However, during the July 2013 reconnaissance, several drums of PCE, left over from the period of use of the vapor degreaser, were being stored in the basement, pending their removal.

2.5 SPINNAKER COATING PROPERTY

During the Phase I and II investigations, soil and groundwater samples were collected on and near the present Spinnaker property (see Figure 6). The facility was previously owned and operated by Brown Bridge Industries, Inc., which was a Division of Kimberly-Clark (K-C) from 1971 to 1994. Previous investigations were also conducted by K-C and by Ohio EPA (Shaw 2006, Ohio EPA 2007). The previous investigations have delineated wide-spread shallow and deep (1 to 12 feet bgs) soil contamination throughout the west parking lot area and outside the northwestern corner of the Spinnaker building, as well as groundwater contamination throughout the site. Contaminants detected in soil or groundwater include chlorinated solvents and associated daughter products (PCE, TCE, DCE, 1,1,1-TCA,

DCA, and vinyl chloride) and other VOCs (BTEX). Previous potential sources identified in the west parking lot area include a former material and waste storage area, including a former bulk storage area, a former hazardous waste area, and a former 300-gallon gasoline underground storage tank. One additional potential source area is a former dry cleaner that was located in the southeastern portion of the west parking lot. However, shallow soil contamination exists throughout the west parking lot outside of these former potential source areas, including in the vicinity of Spinnaker monitoring well KMW-10, which is located at the western site fence, at a depth of 2 to 4 feet bgs. Groundwater samples from Spinnaker monitoring well KMW-10, located at the western (upgradient) site boundary have historically contained the highest reported concentrations of VOCs at the site, with cis-1,2-DCE concentrations ranging as high as more than 100 µg/L. However, no known historical manufacturing operations or other obvious sources of this contamination have yet been identified in this area and none were observed during the July 2013 site reconnaissance.

During Phase I of the RI (May 2012) trace concentrations of TCE (below 1 µg/L) were detected in a groundwater sample EPA collected from deep monitoring well MW-EPA-112D, located near the northwest corner of the Spinnaker plant building. However, TCE was not detected by K-C in a split of this sample and was not detected during a quarterly monitoring event completed by K-C in June 2012, or during Phase II of the RI to date. VOCs have not been detected in deep monitoring well MW-EPA-113D located at the east end of the Spinnaker site during Phase I and initial Phase II of the RI.

An additional area of soil and groundwater contamination has been identified outside the northwestern corner of the Spinnaker building near a former nonhazardous waste storage area, which was used to store empty drums and nonhazardous adhesive materials. Shallow soil and groundwater contamination is also present between the northwest corner of the building and the levee. Elevated concentrations of TCE, 1,1,1-TCA, and cis-1,2-DCE in soil (5 to 9 feet bgs) were also detected in samples collected near the northwest corner of the main building during the initial Phase II RI. Elevated concentrations of PCE, TCE, 1,1,1-TCA, cis-1,2-DCE, DCA, and vinyl chloride have been detected in groundwater near the northwest corner of the main building. However, no known historical manufacturing operations or other obvious sources of this contamination have been identified between the building and the levee, and none were observed during the July 2013 site reconnaissance.

2.6 AREA SOUTHEAST OF SPINNAKER

The area southeast of the Spinnaker building is across the Great Miami River from the City of Troy's East Wellfield. This area appears to be downgradient from both the Water Street plume and the residential area plume (see Figure 7) as a result of pumping influence.

During the Phase I and II investigations, PCE was detected in groundwater samples from monitoring wells MW-EPA-106S, MW-EPA-114S, GZA-2, and MCD-T-14S. In Phase I, PCE was detected in these wells at concentrations ranging from 11 to 24 µg/L. In Phase II, PCE was detected in these wells at concentrations ranging from 9.1 to 25 µg/L. These observations suggest that in addition to the Water Street plume, a portion of the residential area plume contamination (or PCE originating in the vicinity of Union and East Main Streets if a separate source exists at that location) is comingling with the contamination migrating southeastward along East Water Street in the vicinity of the east end of East Water Street, possibly caused by the influence of pumping in the East Wellfield.

In addition, TCE and cis-1,2-DCE were detected in well KMW-4, located on the east end of the Spinnaker property, in Phases I and II. VOCs have not been detected in deep monitoring well MW-EPA-113D, located on the Spinnaker site near well KMW-4.

During Phase II of the RI, the results of a series of VAS profile borings indicated that cis-1,2-DCE may be originating (possibly as a breakdown product of other compounds) west of the river and migrating beneath the river at depths below 50 feet in this general area. Because of the proximity to the significant pumping influence of the East Wellfield and production well PW-18, which consistently exhibits detectable concentrations of cis-1,2-DCE, this area is considered potentially significant with regard to evaluating the potential sources and migration pathways of contamination that has been detected in the East Wellfield production wells.

2.7 OTHER AREAS OF INVESTIGATION

Four surface water and sediment samples were collected from the Great Miami River during Phase I; the locations were based on knowledge of the plume boundaries and suspected source areas at the time. For this reason, no samples were collected southeast of the downstream end of the Spinnaker property. Since then, the Water Street and residential area plumes in the vicinity of the river have been found to extend as far southeast as the vicinity of the northern terminus of Williams Street, about 900 feet southeast of the Spinnaker property.

Soil and groundwater samples will be collected to facilitate evaluation of remedial alternatives in the FS. Soil parameters will be used to evaluate the potential effectiveness of in situ remediation technologies in saturated and unsaturated zones. Groundwater parameters will be used to evaluate the effectiveness of natural attenuation and other in situ remediation technologies. Analysis of VOCs in groundwater will evaluate the relationship between remediation parameters and VOC contaminant concentrations.

SulTRAC will collect three rounds of groundwater elevation measurements during the expanded Phase II investigation. These will include, at least one set of measurements concurrent with a period when the City of Troy is using at least one of each of the production wells in which low levels of VOCs have been detected. These include wells P-14, P-18 and P-17.

SulTRAC will also conduct elevation surveys at the newly installed monitoring wells, as well as, up to 20 Spinnaker monitoring wells that have not been previously surveyed by EPA. Finally, SulTRAC will survey residents regarding private well use because of anecdotal evidence of residents using hand-dug wells for irrigation.

2.8 SUMMARY AND DATA GAPS

Based on the review of the past investigations and results from the Phase I and II investigations, the following key data gaps were identified:

- ***Primary Sources, release mechanisms, and transport mechanisms*** - The original sources and transport mechanisms of contaminant release and transport at the above-mentioned potential source areas need to be further defined and characterized to evaluate whether ongoing release and migration of contaminants are occurring.
- ***Secondary Sources*** - The locations of secondary sources of PCE and TCE affecting groundwater or posing a potential risk to receptors via the VI pathway have not been fully identified. Additional “pockets” of subsurface soil contamination or groundwater contamination may be present in the potential source areas and additional investigation areas (such as the South Clay Street Area).
- ***Receptors*** - Based on the apparent extent of PCE contamination in most recent groundwater samples and sub-slab vapor samples that have been collected, as many as 115 to 140 additional locations that may be within the plume boundaries have not been tested for VI. In addition, anecdotal evidence suggests that some residents may still use private water wells for limited purposes (such as watering gardens). Surveys need to be conducted to assess the number of structures potentially subjected to VI and to assess whether residents are currently using private water wells. Furthermore, additional surface soil sampling is necessary to evaluate current and potential future exposure to site contaminants, and surface water and sediment sampling may be necessary in the Great Miami River in the area southeast of Spinnaker where the groundwater contaminant plume may be migrating under or discharging to the Great Miami River.
- ***Evaluation of Potential Remedial Alternatives*** – Soil and groundwater physiochemical information is needed to evaluate potential remedial alternatives during the FS.

3.0 FIELD SAMPLING ACTIVITY

This expanded Phase II SAP addendum addresses the field activities to be conducted at the East Troy site that are not covered in the SAPs submitted previously. Additional expanded Phase II activities such as general site reconnaissance activities, collecting groundwater elevation measurements, ground surface elevation surveys, surface water and sediment sampling, indoor air sampling, and sub-slab soil vapor sampling, will be conducted in accordance with the procedures and methods described in the Phase I SAP (SulTRAC 2010a) and the Vapor Intrusion Monitoring Program SAP Addendum (SulTRAC 2011b). If installation of groundwater monitoring wells is deemed necessary based on MIP and HRSC groundwater profiling results, monitoring wells will be installed, developed, and sampled in accordance with the procedures and methods described in the Phase I SAP (SulTRAC 2010a) and the Vapor Intrusion Monitoring Program SAP Addendum (SulTRAC 2011b).

As previously discussed, SulTRAC will conduct a source area screening investigation using MIP. Potential source areas assessed during the July 2 and 3, 2013, site visit will be investigated using real-time MIP technology to identify lateral and vertical locations potentially requiring further investigation. The MIP investigation procedures were previously submitted in a separate work plan (SulTRAC 2013c). The MIP investigation will be conducted before the activities described in this SAP and the results will be evaluated and used to optimize locations for HRSC and other activities described in this document, as well to as maximize the efficiency of the additional investigations.

3.1 HRSC GROUNDWATER PROFILING

Based on MIP results, SulTRAC will conduct multiple transects using HRSC direct-push multilevel groundwater profiling to investigate primary and secondary source areas. Although the actual HRSC groundwater profiling locations will be selected based on MIP results, it is anticipated that groundwater profiling will be conducted in the general areas shown on Figures 8 through 12.

The advantage of HRSC technology over traditional groundwater characterization techniques is the ability to collect numerous samples for rapid analysis. In addition to collecting depth-discrete groundwater samples for analysis of target VOCs, HRSC profiling will also provide detailed data relative to the distribution of hydraulic conductivity and hydraulic head, pH, specific conductance, dissolved oxygen, and ORP to correlate VOC concentrations with these other parameters. It is anticipated that depth-discrete groundwater samples will be collected at 5-foot intervals from the water table to a completion depth of up to 80 feet bgs. Based on this interval spacing, it is anticipated that about 14 samples will be collected at each HRSC profiling location. The actual interval spacing (and number of samples collected) will be determined based on (1) results from the MIP investigation, (2) lithology and hydraulic

conductivity readings during HRSC profiling, and (3) mobile laboratory analytical results. Groundwater samples collected will be analyzed on site for target VOCs using a mobile laboratory for fast turnaround. Mobile laboratory results may be used to guide or modify subsequent HRSC sampling locations.

SulTRAC will conduct HRSC direct-push multilevel groundwater profiling at the following potential source areas located within the residential area and Water Street plumes: 10 East Main Street, 432 East Main Street, Clay and Franklin Streets, Hobart, and Spinnaker. The purpose of the groundwater profiling samples is to determine if additional primary or secondary (such as contaminants sorbed to lower-permeability deposits or within the zone of groundwater fluctuation) source material exists in the vicinity of the potential source areas and to evaluate associated release and transport mechanisms. Groundwater samples will be analyzed by EPA SW846 Method 8260C (gas chromatography/mass spectrometry [GC/MS]) for target VOCs using an on-site mobile laboratory for fast turnaround. Target VOCs for the residential area and Water Street plumes include cis-1,2-DCE, PCE, TCE, vinyl chloride. Target VOCs for the Water Street Plume also include BTEX, 1,1,1- TCA, 1,1,2-TCA, and DCA. Water Street plume groundwater profiling samples will include TCA, DCA, and BTEX only at select locations, which will be identified based on previous soil and groundwater data. Mobile laboratory results may be used to guide or modify subsequent HRSC sampling locations. HRSC groundwater profiling will also provide detailed data relative to the distribution of hydraulic conductivity and hydraulic head, pH, specific conductance, dissolved oxygen, and ORP to correlate VOC concentrations with these other parameters.

HRSC groundwater profiling will be conducted at an estimated 27 initial locations and possibly at eight contingency locations. (The need and locations for contingency borings will be determined based on ongoing review of incoming real-time data and will potentially include additional “step-out” locations to determine the extent of contamination.) Groundwater samples are initially planned at 5-foot intervals to a depth of up to 80 feet bgs. Therefore, a total of 574 groundwater samples are estimated at the potential source areas. However, actual sample locations, numbers, depths, and sampling intervals will be adjusted according to MIP results and achievable completion depths based on drilling conditions. At 10 East Main Street, four groundwater profiling locations are planned on the west side of Walnut Street near previous groundwater Geoprobe samples WAL-1, WAL-2, and BW001-WAL, which contained PCE concentrations above the maximum contaminant level (MCL) and vapor intrusion screening level (VISL). In addition, three groundwater profiling locations are planned on the east side of Walnut Street in the vicinity of monitoring wells OEPA-11 and EPA-107I, which contained PCE and TCE above the MCL and VISL. At Clay and Franklin Streets, four groundwater profiling locations are planned on the east side of Clay Street near Franklin Street in the vicinity of monitoring wells OEPA -7 and EPA-119I, which contained PCE concentrations above the MCL and VISL. Well OEPA-7 typically contains some of the

highest concentrations of PCE within the residential area groundwater plume. At 432 East Main Street, one groundwater profiling location is planned adjacent to the building along Union Street in the vicinity of monitoring well EPA-103S, which contains a PCE concentration above the MCL and VISL. Up to an additional three groundwater profiling locations are planned adjacent to the building along Union Street to determine if source material is migrating from this former dry cleaning location. At Hobart, two groundwater profiling locations are planned adjacent to the loading dock, north of the building, where elevated concentrations of chlorinated solvents have been detected in soil. Two groundwater profiling locations are planned on the south side of the building, near the former vapor degreaser. At Spinnaker, six groundwater profiling locations are planned near the northwestern corner of the building, where elevated concentrations of cis-1,2-DCE (detected in City of Troy production wells across the river) and other chlorinated solvents have been detected. Two groundwater profiling locations are planned in the southern portion of the Spinnaker parking lot where a dry cleaner was formerly located. In addition, seven groundwater profiling locations and one contingent location are planned southeast of Spinnaker along the river, across from the Troy production well where cis-1,2-DCE has been detected, to determine if and where groundwater contamination may be migrating under the river. A summary of anticipated HRSC profiling activities is presented below in Table 1.

TABLE 1
HRSC GROUNDWATER PROFILING SUMMARY

Investigation Area	Number of Initial Locations	Number of Contingency Locations	Total Number of Anticipated Locations	Total Number of Samples¹
10 East Main Street	4 on west side of Walnut Street; 3 on east side of Walnut Street	2	9	126
432 East Main Street	4 on east side of building	1	5	70
Hobart	2 on north side of building near loading dock area; 2 on south side of building near former vapor degreaser area	2	6	84
Spinnaker	6 around northwest corner of building; 2 in parking lot at location of former dry cleaner	2	10	140
Franklin/Clay Street	4 north of Franklin Street	1	5	70
Area southeast of Spinnaker	7 between existing wells KMW-4 and MCD-T-14S	1	8	112
Totals:	34	9	43	602

Notes:

1 The total number of samples is based on 14 investigative samples per location and does not include field duplicate samples to be collected at a rate of 1 per 10 investigative samples or equipment rinsate samples collected at each location.

Sample numbers and locations may be adjusted based on membrane interface probe investigation results.

HRSC High resolution site characterization

3.2 SOIL SAMPLING

Surface and subsurface soil samples will be collected to delineate the nature and extent of contamination at potential source areas. A total of 28 surface soil samples will be collected at 25 locations at the Hobart and Spinnaker potential source areas (see Figures 10 and 11). The Water Street plume originates on the Hobart property; in addition, soil sampling completed at the Spinnaker site has indicated the presence of contamination in soil at depths above the water table, suggesting the presence of additional sources on that site.

MIP data and accessibility will be considered in selecting the final locations for soil samples. Four surface soil samples (0 to 6 inches bgs) will be collected from the eastern portion of the Hobart property for evaluation of the potential future resident exposure scenario. Surface soil samples will be collected where visual evidence, odors, or photoionization detector (PID) screening indicates surficial contamination. In addition, one surface soil sample will be collected from each of two sub-slab soil boring locations. The surface soil samples will be collected from 0 to 6 inches bgs, immediately beneath the building slab. Sub-slab soil borings will be located beneath the loading dock area, where elevated concentrations of chlorinated solvents have been detected, and in the vicinity of the former vapor degreaser. In addition, eight surface soil samples will be collected from soil borings in the vicinity of the loading dock to further delineate the nature and extent of soil contamination previously identified in this area.

At Spinnaker, three surface soil samples (0 to 6 inches bgs) will be collected from the unpaved area between the building and the levee for evaluation of the current and future potential exposure scenarios. The remaining on-site areas are paved. Furthermore, one surface soil sample will be collected from each of two sub-slab soil boring locations. The surface soil samples will be collected from 0 to 6 inches bgs, immediately beneath the building slab. Sub-slab soil borings will be located near the northeastern corner of the building, where elevated contaminant concentrations have been detected outside the building, and in the northwestern corner of the building near a sump. In addition, one surface soil sample will be collected from each of six soil boring locations installed in the parking lot area to further define the nature and extent of contamination in areas where no RI or other soil data exist.

Contingent on accessibility of sampling locations, additional subsurface soil samples may be collected at the 10 East Main Street Residential Plume potential source area if MIP investigation results indicate that soil contamination is present in this area. At 432 East Main, two sub-slab soil samples will be collected indoors near a floor drain that may have been used to dispose of dry cleaning fluids. Two surface soil samples will be collected outdoors near exhaust fans (see Figure 9).

A total of 40 subsurface soil samples will be collected from 18 locations at the Hobart and Spinnaker potential source areas. At Hobart, two subsurface soil samples will be collected in each of two sub-slab soil boring locations at two additional depth intervals between the uppermost surface soil sample and the water table (expected to be about 12 to 15 feet bgs). One sub-slab boring is planned beneath the loading dock and one in the vicinity of the former vapor degreaser near the central portion of the Hobart building. Eight soil borings will be installed in the vicinity of the loading dock area to further delineate the nature and extent of soil contamination previously identified in this area. Two subsurface soil samples will be collected in each of the eight soil boring locations at two additional depth intervals between the uppermost surface soil sample and the water table (expected to be about 12 to 15 feet bgs) (see Figure 10).

At Spinnaker, two subsurface soil samples will be collected in each of two sub-slab soil boring locations at two additional depth intervals between the uppermost surface soil sample (listed above) and the water table (expected to be about 12 to 15 feet bgs). Two sub-slab borings are planned near the northeastern portion of the building, where elevated contaminant concentrations have been detected outside the building. Six soil borings will be installed in the parking lot area to further define the nature and extent of contamination in areas where no RI or other soil data collected by Spinnaker exist. Two subsurface soil samples will be collected in each of six sub-slab soil boring locations at two additional depth intervals between the uppermost surface soil sample (listed above) and the water table (expected to be about 12 to 15 feet bgs) (see Figure 11). Subsurface soil samples will be collected at depth intervals where visual evidence, odors, or PID screening indicates soil contamination. Surface and subsurface soil samples will be analyzed for VOCs through the EPA CLP. The procedures for collection and analysis of soil samples are presented in SulTRAC's Phase I RI QAPP (SulTRAC 2010a).

Subsurface soil samples will be selected from each boring based on field observations. Soil samples will be collected from depth intervals that appear to exhibit the highest contamination based on field observations and PID screening. Soil samples will be screened for visual coloration changes and for organic vapors using a PID. In the event that field screening and observations do not identify a section to be sampled between the top and bottom of the interval, SulTRAC will by default collect one soil sample for analysis from each of an upper depth (3 to 5 feet bgs) and lower depth (8-10 feet bgs), as these depths are within the range applicable to evaluating risk to construction workers. Sampling within these intervals will be biased toward fine-grained material underlying coarser-grained material, if any exists. All expanded Phase II soil sampling will be conducted following the same soil sampling procedures described in the Phase I SAP (SulTRAC 2010a), and samples will be analyzed by a CLP laboratory for TCL VOCs. A summary of soil sampling activities is presented below in Table 2.

TABLE 2
SOIL SAMPLING SUMMARY

Investigation Area	Number of Surface Soil Samples	Number of Subsurface Soil Samples
10 East Main Street	NA	TBD based on MIP results
432 East Main Street	Four (Two outside the building near the exhaust fan plus two from the borings inside the building)	Four (Two from each boring inside the building)
Hobart	14 (Four in the eastern portion of the property for evaluation of the potential future resident exposure scenario, eight near the loading dock, and two from the borings inside the building)	20 (Two from each of 10 borings, including eight borings near the loading dock and two borings inside the building)
Spinnaker	11 (Three from the unpaved area between the building and the levee for evaluation of the current and future potential exposure scenarios, six from borings in parking lot, and two from the borings inside the building)	16 (Two from each of six borings in parking lot and two borings inside the building)
Totals:	29	40

Notes:

Sample numbers and locations may be adjusted based on membrane interface probe investigation results.
Sample numbers do not include field duplicate samples to be collected at a rate of 1 out of 10 investigative samples.

NA Not applicable
TBD To be determined

In addition, select soil samples may also be analyzed for additional physiochemical parameters not included in the Phase I and II investigations. This information will be used to evaluate potential remedial options in the FS. These parameters are discussed further in Section 3.6.

3.3 SUB-SLAB SOIL VAPOR AND INDOOR AIR SAMPLING

Some of the locations of the suspected primary sources of the groundwater contamination are covered by structures. As a result, sub-slab vapor and indoor air samples may provide a means of gathering additional information regarding residual contamination at these locations, as well as provide data to support the human health risk assessment. Potential locations identified to date include (1) the basement of the First Presbyterian Church addition that covers the footprint of the former location of 10 East Main Street, and (2) the basement of the main building and the grade-level structures associated with 432 East Main Street. Completion of sampling at any locations is contingent on access. SulTRAC will follow the sampling methodologies and procedures presented in the Vapor Intrusion Monitoring Program SAP addendum (SulTRAC 2011b), which are based on Ohio EPA's vapor intrusion investigation guidance (Ohio EPA 2010) and EPA Region 5's Vapor Intrusion Handbook (EPA 2010). The overall sampling procedures are as follows. Indoor air monitoring will be conducted concurrently with sub-slab vapor monitoring in each structure. The sequence of the indoor air and sub-slab sampling will be (1) survey the structure to be sampled, (2) install the sub-slab sampling ports, (3) wait a period of about 24 hours after sub-slab installation, (4) collect the sub-slab and indoor air samples (as well as ambient air samples), and (5) arrange sample pickup and shipment the following day. Sub-slab soil gas and indoor air samples will be collected through a selective ion method (SIM)-certified stainless steel Summa canister VOC sampler and SIM-certified 24-hour flow controller. In addition, leak testing will be conducted before samples are collected following the methods and procedures specified in the Vapor Intrusion Monitoring Program SAP addendum (SulTRAC 2011b).

Figures 8 and 9 show the proposed expanded Phase II sub-slab and indoor air sampling locations. Table 3 lists all sub-slab and indoor air samples to be collected, the estimated number of samples, and specific information on collection. Final locations are subject to approval by EPA and Ohio EPA as well as response and permission from the property owners.

TABLE 3
SUMMARY OF SUB-SLAB AND INDOOR AIR SAMPLING

Investigation Area	Number of Sub-slab Locations	Number of Indoor Air Locations ¹	Number of Ambient Air Locations ²	Total Number of Sampling Locations	Total Number of Samples ³
10 East Main Street	3	3	1	7	7
432 East Main Street	3	3	1	7	7

Notes:

¹ Indoor air sampling will typically be conducted at a height of 3 and not more than 5 feet above the floor.

² One ambient air sample will be collected at each location concurrent with indoor air sampling activities.

³ The total number of samples does not include field duplicate samples to be collected at a rate of 1 per 10 investigative samples.

All indoor air and sub-slab soil vapor samples will be analyzed by a subcontracted laboratory. Indoor air and sub-slab soil vapor sample analysis will include the target VOCs listed in Worksheet #15 of the QAPP (SulTRAC 2011b). Indoor air and sub-slab vapor samples will be collected in specially prepared canisters and analyzed by GC/MS using EPA Compendium Method TO-15 SIM – Determination of Toxic Organic Compounds in Ambient Air (EPA 1999), for targeted chlorinated VOCs.

Table 4 specifies the residential and commercial screening levels that will apply for investigating the chlorinated VOC and BTEX compounds anticipated to be present at the site.

TABLE 4
SCREENING LEVELS FOR VAPOR INTRUSION MONITORING

Chemical	Residential/Schools		Commercial/Industrial	
	Sub-Slab Vapor Probe Screening Level ($\mu\text{g}/\text{m}^3$) ^a	Indoor Air Screening Level ($\mu\text{g}/\text{m}^3$) ^a	Sub-Slab Vapor Probe Screening Level ($\mu\text{g}/\text{m}^3$) ^a	Indoor Air Screening Level ($\mu\text{g}/\text{m}^3$) ^a
Benzene	3.1	0.31	16	1.6
1,1-DCA	15	1.5	77	7.7
1,2-DCA	0.94	0.094	4.7	0.47
cis-1,2-DCE	350 ^b	35 ^b	1,500 ^b	150
Ethylbenzene	9.7	0.97	49	4.9
PCE	94	9.4	470	47
1,1,1-TCA	52,000	5,200	220,000	22,000
1,1,2-TCA	1.5	0.15	7.7	0.77
TCE	4.3	0.43	30	3
Toluene	52,000	5,200	220,000	22,000
Vinyl chloride	1.6	0.16	28	2.8
Xylene	1,000	100	4,400	440

Notes:

- ^a EPA vapor intrusion screening level calculator screening level (EPA 2013), unless otherwise noted
^b Ohio Department of Health (ODH) Site-Specific Screening Level (ODH 2012)

$\mu\text{g}/\text{m}^3$ Micrograms per cubic meter

1,1-DCA	1,1-Dichloroethane	1,2-DCA	1,2-Dichloroethane
cis-1,2-DCE	cis-1,2-Dichloroethene	PCE	Tetrachloroethene
1,1,1-TCA	1,1,1-Trichloroethane	1,1,2-TCA	1,1,2-Trichloroethane
TCE	Trichloroethene		

3.4 SURFACE WATER AND SEDIMENT SAMPLING

During Phase I of the RI, surface water and sediment samples were collected from four locations to evaluate the potential for discharge of contaminated groundwater to impair water or sediments in the Great Miami River. Since that time, ongoing data collection during the RI has indicated that the groundwater contamination extends farther southeast than was known at the time of the Phase I surface water and sediment sampling activities. In addition, groundwater monitoring data collected at Miami Conservancy District's (MCD) T-13/14 piezometer location, which is adjacent to the west bank of the river in the area near Williams Street, has indicated the presence of groundwater contamination in proximity to a likely discharge boundary. For this reason, SulTRAC will collect up to four surface water and sediment samples from two locations in the area downstream from the Spinnaker site (see Figure 12).

Samples will be collected during base flow conditions, to the extent possible. The Great Miami River in the area is very shallow at most times during the year; specifically, during periods when the stream will be easily accessible for sampling. Before sampling, a water quality meter will be submerged in the river to obtain in-stream water quality parameter measurements of dissolved oxygen, temperature, pH, and specific conductance at the target depth. Immediately after the surface water samples are collected, a collocated sediment sample will be collected at the same surface water sampling location. Collection of sediment samples will be contingent on the presence of fine-grained sediment in the river. Observations made during previous Phases of investigations indicate that the river bed primarily contains gravel and larger rocks with very little sediment present at some times, suggesting frequent scouring of sediments during heavy flow. Surface water and sediment sampling will be conducted following the methods and procedures described in the Phase I SAP (SulTRAC 2010a). The surface water and sediment samples will be submitted to a CLP laboratory for analysis of TCL VOCs.

3.5 HYDROGEOLOGIC INVESTIGATION AND GROUNDWATER SAMPLING – VOCs

In addition to HRSC groundwater profiling, water level elevation will be measured at all existing monitoring wells. SulTRAC will also conduct surface elevation surveys at newly installed monitoring wells and up to 20 existing Spinnaker monitoring wells not previously surveyed by EPA. All water level measurements and surface elevation surveys will be conducted using the same sampling methods and procedures described in the Phase I SAP (SulTRAC 2010a). In addition, SulTRAC will survey residents regarding private well use because of anecdotal evidence of residents using hand-dug wells for irrigation.

At least three sets of groundwater elevation measurements will be collected during the expanded Phase II investigation. These will include at least one set of measurements concurrent with a period when the City of Troy is using at least one of each of the production wells where low levels of VOCs have been

detected. These include wells P-14, P-18 and P-17. Groundwater elevation measurements will be collected using procedures specified in the approved Phase I SAP (SulTRAC 2010a).

Currently, at least one additional groundwater monitoring well is planned for the expanded Phase II investigation. This monitoring well will be installed in the vicinity of Floral Avenue to provide a fixed monitoring point at the downgradient end of the residential area PCE plume. It is anticipated that this well will be installed using hollow stem auger drilling techniques. Continuous subsurface soil samples will be collected while drilling for identifying lithology. Drilling, logging, and well installation procedures will be consistent with those in the approved Phase I SAP, with the exception that auger techniques (rather than rotasonic methods) will be used because this well is anticipated to be only approximately 20 feet deep.

Groundwater samples will be collected from the new monitoring well and analyzed for VOCs by an EPA CLP laboratory in accordance with the Phase I SAP (SulTRAC 2010a).

Additional groundwater samples will be collected at eight monitoring well locations and analyzed for remediation parameters. VOCs will also be analyzed for these remediation parameter locations. Analysis of VOCs in groundwater will evaluate the relationship between remediation parameters and VOC contaminant concentrations. This information will be used to evaluate potential remedial options in the FS. Remediation parameters and associated VOC analyses are discussed further in Section 3.6.

3.6 REMEDIATION PARAMETERS

Physiochemical information for soil and groundwater is needed to evaluate potential remedial alternatives during the FS. Soil and groundwater samples will therefore be collected to facilitate evaluation of remedial alternatives in the FS. Soil parameters will be used to evaluate the potential effectiveness of in situ remediation technologies in saturated and unsaturated zones. Soil remediation parameters include total organic carbon, grain size/particle size distribution, hydraulic conductivity, soil permeability, bulk soil density, and porosity. Remediation parameter sample locations for the residential plume area soil are located near monitoring wells EPA-107I and OEPA-7, where the highest PCE concentrations have historically been detected. Near well EPA-107I, soil samples will be collected at about 20 and 50 feet bgs because significant contaminant concentrations have been detected at both depths and the hydrogeologic units at each of these depths are different. Near well OEPA-7, soil samples will also be collected from the sand and gravel unit at about 20 feet bgs and the clayey gravel unit at about 50 feet bgs. Soil remediation parameter samples in the Spinnaker area will be collected from one soil boring near the former chemical storage area near the center of the parking lot at depths of about 5 feet (fill material), 10

feet (clay), and 20 feet bgs (sand and gravel). Actual samples depths may be modified in the field to ensure that samples are collected from each of the three strata that underlie the site.

Soil samples will be collected in accordance with the Phase I SAP (SulTRAC 2010a). SulTRAC will collect samples for analysis of hydraulic conductivity, soil permeability, bulk soil density, and porosity using Shelby Tubes. Shelby Tubes will be pushed downward into the soil to the desired depth. After the Shelby Tube is retrieved, both ends of the tube will be capped. Each tube will be marked to identify the top and bottom of the sample, the sampling location, date, and time of collection.

Groundwater remediation parameters will evaluate the effectiveness of natural attenuation and other in situ remediation technologies. Groundwater remediation parameters include anions (chloride, sulfate, nitrate, fluoride, and bromide), ferrous iron, dissolved gases (methane, ethane, and ethene), total organic carbon, alkalinity, and total dissolved solids. The following groundwater field parameters will be collected from each well where remediation parameter sampling will be conducted: temperature, pH, specific conductance, dissolved oxygen, and ORP. Residential plume area groundwater remediation parameter sample locations are monitoring wells EPA-107I, EPA-116S, and OEPA-7. These wells are located in the western, central, and eastern portions of the residential area groundwater plume. The highest PCE concentrations have historically been detected at wells EPA-107I and OEPA-7.

Groundwater remediation parameter samples for the Hobart area will be collected from monitoring well EPA-110S, located near the center of the property. Spinnaker area groundwater remediation parameter samples will be collected from monitoring wells OEPA-3 and KMW-10. Elevated contaminant concentrations have been detected in both locations. Furthermore, VOCs will also be analyzed at each of the groundwater remediation parameter locations to evaluate the relationship between remediation parameters and VOC contaminant concentrations. In addition, chloride will be analyzed for groundwater samples collected from upgradient monitoring wells EPA-108S and EPA-122S. Groundwater samples will be collected in accordance with the Phase I SAP (SulTRAC 2010a).

Tables 5 and 6 summarize the additional parameters that will be analyzed to support the identification and evaluation of potential remedial alternatives.

TABLE 5
SUMMARY OF GROUNDWATER REMEDIATION PARAMETERS

Monitoring Well Location	Analytical Parameters
<i>Residential Area Groundwater Plume</i>	
EPA-108S	Chloride (background location)
EPA-107I OEPA-7 EPA-116S	<ul style="list-style-type: none"> • Anions (chloride, sulfate, nitrate, fluoride) • Ferrous iron • Dissolved gases (methane, ethane, ethene) • Total organic carbon • Alkalinity • Total dissolved solids
<i>Hobart</i>	
EPA-122S	Chloride (background location)
EPA-110S	<ul style="list-style-type: none"> • Anions (chloride, sulfate, nitrate, fluoride) • Ferrous iron • Dissolved gases (methane, ethane, ethene) • Total organic carbon • Alkalinity • Total dissolved solids
<i>Spinnaker</i>	
OEPA-3 KMW-10	<ul style="list-style-type: none"> • Anions (chloride, sulfate, nitrate, fluoride) • Ferrous iron • Dissolved gases (methane, ethane, ethene) • Total organic carbon • Alkalinity • Total dissolved solids

TABLE 6
SUMMARY OF SOIL REMEDIATION PARAMETERS

Sample Location	Analytical Parameters
<i>Residential Area Groundwater Plume</i>	
Soil samples will be collected near monitoring wells EPA-107I and OEPA-7 at about 20 and 50 feet bgs	<ul style="list-style-type: none"> • Total organic carbon • Grain size/particle size distribution • Bulk soil density and porosity • Hydraulic conductivity and soil permeability
<i>Spinnaker</i>	
One soil boring near the former chemical storage area near the center of the parking lot at depths of about 5 feet (fill material), 10 feet (clay), and 20 feet bgs (sand and gravel)	<ul style="list-style-type: none"> • Total organic carbon • Grain size/particle size distribution • Bulk soil density and porosity • Hydraulic conductivity and soil permeability

Notes:

Actual samples depths may be slightly modified in the field to ensure that samples are collected from each of the strata that underlie the site.

Hydraulic conductivity and soil permeability will be analyzed only from low-permeability material (clay).

bgs Below ground surface

3.7 GENERAL SAMPLING CONSIDERATIONS

All expanded Phase II sampling locations will be surveyed using global positioning system (GPS) or traditional surveying methods for inclusion on site figures and in the project data base. Field conditions, drilling and sampling observations, and other pertinent information will be recorded by field team members in field logbooks, field data sheets, or through a photographic record, as described in the Phase I SAP (SulTRAC 2010a). Other general sampling considerations that apply to most or all of the sampling activities described in this SAP addendum include the following:

- All proposed sampling locations in this SAP addendum are contingent on EPA's obtaining access from property owners.
- Proposed sampling locations may be modified based on the physical location of above-head and underground utilities.
- Proposed sampling locations may be modified based the physical constraints resulting from the equipment required to perform these activities.
- Proposed sampling depths may be modified if refusal is encountered as a result of actual drilling conditions.

- The sampling program is designed to take advantage of real-time data collection techniques to optimize sampling effectiveness and efficiency. If, during the expanded Phase II activities, ongoing evaluation of incoming data indicates a need to add, delete, or move proposed sampling locations, SulTRAC will consult with EPA and Ohio EPA beforehand.

3.8 DECONTAMINATION PROCEDURES

SulTRAC will follow decontamination procedures specified in the RI/FS Phase I SAP (SulTRAC 2010a). When possible, sampling methods will use dedicated or disposable materials to prevent cross contamination. In addition, new pre-preserved sample containers will be used to collect environmental samples.

Decontamination of subcontractor equipment will be the responsibility of the subcontractors under the supervision of SulTRAC field personnel. Subcontractors must decontaminate the HRSC groundwater profiler before initial use and between sampling locations to demonstrate that cross contamination does not occur. The direct-push subcontractor will also be required to decontaminate all drilling equipment before the start of expanded Phase II and after it comes in contact with potentially contaminated materials.

3.9 SAMPLE HANDLING PROCEDURES

Samples collected during expanded Phase II will be analyzed in one of three ways: (1) by the on-site mobile laboratory, (2) by a subcontracted laboratory, or (3) by a CLP laboratory. Sample handling and chain-of-custody (COC) procedures for samples to be analyzed by a subcontracted laboratory or a CLP laboratory will be in accordance with the procedures specified in the Phase I SAP (SulTRAC 2010a) and Vapor Intrusion Monitoring Program SAP addendum (SulTRAC 2011b). Sample handling and COC procedures for samples to be analyzed by the mobile laboratory will be as follows:

- Groundwater samples collected during HRSC profiling will be stored on ice and delivered by a SulTRAC field team member to the mobile laboratory as quickly as possible.
- The mobile laboratory sample custodian will log in each sample by recording, at a minimum, the sample location, sample depth, sample identification number, and time and date of collection.
- Mobile laboratory personnel will provide spreadsheets with laboratory analytical results within 24 hours after samples are collected.
- Mobile laboratory personnel will provide final laboratory analytical results within 2 weeks after the project is complete.

Laboratory analytical methods to be used for each type of sample collected are summarized in Table 7 below.

TABLE 7
ANALYTICAL METHODS SUMMARY

Parameter	Analytical Method
Soil and Sediment	
VOCs (CLP laboratory)	CLP SOW SOM01.2
Surface Water	
VOCs (CLP laboratory)	CLP SOW SOM01.2
Groundwater – New Monitoring Well	
VOCs (CLP laboratory)	CLP SOW SOM01.2
Sub-Slab Vapor, Indoor Air, And Ambient Air	
VOCs (subcontracted laboratory)	TO-15 SIM
Groundwater – HRSC Profiling	
VOCs (mobile laboratory)	EPA SW-846 Method 8260
Soil – Remediation Parameters	
Total organic carbon (subcontracted laboratory)	EPA SW-846 Method 9060A, modified
Grain size/particle size (subcontracted laboratory)	ASTM Method D422
Bulk soil density and porosity (subcontracted laboratory)	ASTM Method D5084
Hydraulic conductivity and soil permeability (subcontracted laboratory)	ASTM Method D7263
Groundwater – Remediation Parameters	
Anions – chloride, sulfate, nitrate, fluoride, and bromide (TestAmerica)	EPA Method 300.0
Ferrous Iron (TestAmerica)	SM 3500-Fe B EPA Method RSK-175
Dissolved gases – methane, ethane, ethene (TestAmerica)	EPA Method RSK-175
Total organic carbon (TestAmerica)	SM 5310C
Alkalinity (TestAmerica)	SM 2320B
Total dissolved solids (TestAmerica)	SM 2540C

Notes:

ASTM American Society for Testing and Materials (now ASTM International)
CLP Contract Laboratory Program
EPA U.S. Environmental Protection Agency
HRSC High resolution site characterization groundwater profiling samples to be analyzed by mobile laboratory using rapid turnaround.
SM Standard Methods for the Examination of Water and Wastewater
SOW Statement of work
VOC Volatile organic compound

Sample containers, preservatives, holding times, identification, documentation, COC, packaging, and shipping are specified in the Phase I SAP (SulTRAC 2010a). SulTRAC will use 6-liter Summa canisters to collect sub-slab and indoor air samples. Procedures specific to handling sub-slab vapor and indoor air samples are specified in the Vapor Intrusion Monitoring Program SAP addendum (SulTRAC 2011b). As a result of the use of a mobile laboratory and the additional analytical parameters not previously included in the Phase I and II investigations, a complete summary of sample containers, preservatives, and holding times are presented below in Table 8.

TABLE 8
SAMPLE CONTAINER, PRESERVATION, AND HOLDING TIMES

Matrix	Analyte	Sample Container	Preservation Requirements	Maximum Holding Time (preparation/analysis)¹
Soil and Sediment	VOCs	Three 40-mL glass containers with PTFE-lined septa and open-top screw caps, pre-weighted and containing magnetic stir bars, and one 2-ounce container of sample filled with no headspace for determination of moisture content.	Iced 4 °C ± 2 °C	48 hours to preservation at laboratory/ 14 days for analysis following preservation
Water	VOCs	Three 40-mL glass vials with PTFE-lined septa and open-top screw caps	No headspace; cool to 4±2°C; adjust pH to less than 2 with HCl	7 days/14 days
Water	VOCs (mobile laboratory)	Three 40-mL glass vials with PTFE-lined septa and open-top screw caps	No headspace; cool to 4±2°C	48 hours
Sub-Slab Vapor, Indoor Air, and Ambient Air	VOCs	6-liter SIM-certified stainless steel SUMMA canister with SIM-certified 24 hour flow controller.	None. Shipped in the shipping containers they were received in.	30 days
Soil – RP	Total organic carbon	One 4-oz wide mouth glass jar fitted with PTFE-lined screw cap	Cool to 4±2°C Immediately after collection	28 Days
Soil – RP	Grain size/particle size	One 8-oz wide mouth glass jar fitted with polyethylene screw cap	None	None
Soil – RP	Bulk soil density and porosity	One Shelby tube, capped	None	None
Soil – RP	Hydraulic conductivity and soil permeability	One Shelby tube, capped	None	None
Groundwater – RP	Anions - chloride, sulfate, nitrate, fluoride, and bromide	One 500-mL plastic bottle OR one 1-Liter plastic bottle for anions, TDS, and ferrous iron	Cool to 4±2°C Immediately after collection	28 Days

TABLE 8
SAMPLE CONTAINER, PRESERVATION, AND HOLDING TIMES

Matrix	Analyte	Sample Container	Preservation Requirements	Maximum Holding Time (preparation/analysis)¹
Groundwater – RP	Ferrous Iron	One 250-mL plastic bottle OR one 1-Liter plastic bottle for anions, TDS, and ferrous iron	Cool to 4±2°C Immediately after collection	24 Hours
Groundwater – RP	Dissolved Gases - methane, ethane, ethene	Three 40-mL glass vials with PTFE-lined septa and open-top screw caps	No Headspace Adjust pH to <2 with HCl Cool to 4±2°C Immediately after collection	14 Days
Groundwater – RP	Total organic carbon	Two 40-mL glass vials with PTFE-lined septa and open-top screw caps	H ₂ SO ₄ to pH < 2 and cool to 4±2°C Immediately after collection	28 Days
Groundwater – RP	Alkalinity	One 250-mL plastic bottle	Cool to 4±2°C Immediately after collection	14 Days
Groundwater – RP	TDS	One 500-mL plastic bottle OR one 1-Liter plastic bottle for anions, TDS, and ferrous iron	Cool to 4±2°C Immediately after collection	7 Days

Notes:

µm	Micrometer
°C	Degrees Celsius
CLP	Contract Laboratory Program
HCl	Hydrochloric acid
HDPE	High-density polyethylene
H ₂ SO ₄	Sulfuric acid
mL	Milliliter
NR	Not required
PTFE	Polytetrafluoroethene
RP	Remediation parameter
TDS	Total dissolved solids
VOC	Volatile organic compound

¹ Holding time is measured from time of sample collection to the time of sample extraction and analysis.

3.10 SAMPLE IDENTIFICATION

Samples will be identified by a unique sample identification number (see Table 9). The identifier will be composed of the following information:

- Matrix
- Sample location (for example, monitoring well identification number, MW-14)
- Area designation
- Sample date
- Sample type (field, field duplicate, or quality assurance and quality control [QA/QC]).

Each sample will also be assigned an identifying number by CLP Scribe software. Scribe was developed to expedite sample documentation, track samples from the field to the laboratory, and reduce the most common documentation issues associated with sampling. Before or during the sampling event, the user will enter information on the site regarding the project, sampling team, analysis, location, matrix, collection time and date, and sample and tag numbers. SulTRAC will identify specific sample names after the start of the field campaign, but before intrusive field activities begin, because preliminary activities to be completed before the sampling event may alter sample locations.

Standard EPA methods will be used and data packages will be prepared in accordance with the requirements specified in the QAPP for groundwater and soil samples to be analyzed for remediation parameters, and vapor intrusion samples analyzed by subcontracted laboratories and HRSC groundwater profiling samples analyzed by an on-site mobile laboratory. These samples will be identified using the nomenclature described in Table 9. However, the CLP Scribe requirements will not apply to these samples because these samples will not be analyzed through EPA Central Regional Laboratory (CRL) or the CLP.

TABLE 9
GENERALIZED SAMPLE IDENTIFICATION SCHEME

Matrix		Location Number	Sample Method/Or Location Clarifier	Depth in Feet	Date	Example Identification	Notes
Soil Boring – soil	SB	013 (3 digits)	Example: Remediation Parameters – RP	10	1113 = November 2013	SB013-RP-10-1113	All sample locations will have new sample ID, in numerical order. The depth listed is the bottom of the sample interval.
Soil Boring – groundwater	BW	013 (3 digits)	Example: High Resolution Site Characterization Groundwater Profiling – HRSC	20	1113 = November 2013	BW013-HRSC-20-1113	All sample locations will have new sample ID, in numerical order. The depth listed is the bottom of the sample interval.
Sub-Slab Vapor	SSV	003 (3 digits)	856 Franklin 856-FRA	NA	1113 = November 2013	SSV-003-856-FRA-1113	All sample locations will have new sample ID, in numerical order.
Indoor Air	IA	003	856 Franklin 856-FRA	NA	1113 = November 2013	IA-003-856-FRA-1113	All sample locations will have new sample ID, in numerical order
Surface Water	SW	001 (3 digits)	Great Miami River- Great Miami River	NA	1113 = November 2013	SW001-Great Miami River-1113	All sample locations will have new sample ID, in numerical order.
Sediment	SD	001 (3 digits)	Great Miami River- Great Miami River	NA	1113 = November 2013	SD001-Great Miami River-1113	All sample locations will have new sample ID, in numerical order
Groundwater	MW-	14 (no digit requirement)	OEPA, TROY, SP (Spinnaker) or EPA	S = Shallow D = Deep (if applicable)	1113 = November 2013	MW-OEPA-6S-1113 MW-EPA-107I-1113 etc.	Same sample locations will have same sample location number with different designation and date in sample ID

Notes:

BW Soil boring – groundwater
HRSC High resolution site characterization
ID Identification
MW Monitoring well
NA Not applicable

SB Soil Boring
SD Sediment
SSV Sub-slab vapor
SW Surface water
VAS Vertical aquifer sampling

3.11 INVESTIGATION-DERIVED WASTE AND HEALTH AND SAFETY

Investigation-derived waste (IDW) is waste generated from an activity related to determining the nature and extent of contamination at the East Troy site. Disposal of IDW is specified in the RI/FS Phase I SAP (SulTRAC 2010a) and the Vapor Intrusion Monitoring Program SAP Addendum (SulTRAC 2011b). Because of the direct-push drilling methods being used, minimal IDW is expected to result from expanded Phase II sampling activities. Soil cuttings and purge water will be containerized in 55-gallon drums and managed as either potentially hazardous or nonhazardous waste, depending on the location where the material was generated, field observations, and historical data. For example, purge water from monitoring well MW-EPA-107I will be managed as a potentially hazardous waste based on the known presence of high concentrations of PCE in past groundwater samples from this well. Material from such locations will be segregated from waste that will be managed as nonhazardous waste. Final determination will be contingent on receipt of analytical data from the soil and groundwater sampling. All concrete slab chips or cuttings and any sub-slab material encountered will be containerized at each location and removed from the premises for disposal in 55-gallon drums with IDW resulting from other drilling and sampling activities. Additional IDW generated as a result of expanded Phase II sampling may include disposable personal protective equipment (PPE) and sampling equipment such as tubing. Disposable PPE and tubing will be managed as nonhazardous solid waste; therefore, this waste will be double bagged and disposed of with municipal trash.

As specified in the RI/FS Phase I SAP (SulTRAC 2010a), all field activities will be conducted in accordance with the approved RI/FS Health and Safety Plan (HASP) (SulTRAC 2010b). Before field activities begin, all SulTRAC field personnel and subcontractors will read and sign the HASP, indicating that they understand the plan and agree to operate in accordance with its requirements. Daily tailgate meetings will be conducted to review daily activities and task-specific hazards.

3.12 QUALITY ASSURANCE/QUALITY CONTROL REQUIREMENTS

The QA/QC requirements for the East Troy site are specified in the Phase I RI SAP (SulTRAC 2010a), Vapor Intrusion Monitoring Program SAP addendum (SulTRAC 2011b), and this expanded Phase II SAP addendum. A copy of each SAP will be maintained by the field sampling team for immediate reference in resolving any QA issues that might arise during field activities.

QC samples for all samples sent to the CLP laboratory will be collected at the following frequencies:

- **Field Duplicate:** One per 10 environmental samples will be collected, with a minimum of one per sample matrix.
- **Trip Blank Samples:** One trip blank will be included in each cooler containing aqueous samples for analysis for VOCs.
- **Matrix spike and matrix spike duplicate (MS/MSD) Samples:** One per 20 environmental samples per matrix will be collected.
- **Rinsate Blank Samples:** One per day of sampling to verify quality of decontamination procedures of non-disposable equipment (if necessary).

Field duplicate samples consist of two separate samples collected from the same sampling location and depth, using the same equipment and sampling procedures. A trip blank is a clean sample of a matrix that is taken from the laboratory to the sampling site and transported back to the laboratory, without having been exposed to sampling procedures (typically an aqueous sample analyzed only for VOCs). The trip blank sample is not to be labeled or identified as a trip blank for the laboratory. A rinsate blank sample is obtained by running analyte-free water over or through nondisposable or nondedicated sample collection equipment. These samples are used to determine whether contaminants have been introduced by contact of the sample medium with sampling equipment.

An MS/MSD sample is an environmental sample divided into two separate aliquots, each of which is spiked by the laboratory with known concentrations of target aliquots. The two spiked aliquots, in addition to an unspiked sample aliquot, are analyzed separately, and the results are compared to evaluate the effects of the matrix on the precision and accuracy of the analysis. MS/MSD samples generally require collecting triple sample volume for VOCs and double sample volume for all other analyses for groundwater samples. MS/MSDs for samples of solid matrices do not require collection of extra volume. All samples should be identified as MS/MSD for the laboratory.

Equipment blanks will not be collected for soil samples because dedicated or disposable sampling equipment will be used. For example, soil samples will be collected using direct-push coring devices with disposable liners to prevent soil from coming in contact with the core barrel.

Field duplicate and MS/MSD samples will be collected based on the CLP frequencies presented above for HRSC groundwater profiling samples analyzed in the on-site mobile laboratory. No trip blank samples will be collected because the samples are not shipped off site. Between each sampling location, the HRSC groundwater profiling sampling system will be decontaminated and an equipment rinsate sample will be collected. Equipment blank results will be provided to the field team before sampling the next location.

QA/QC samples for sub-slab soil vapor and indoor air samples will include field duplicates. However, MS/MSD and equipment rinsate samples are not applicable. Sub-slab soil vapor and indoor air samples will be collected using canisters and flow regulators thoroughly cleaned and certified by the laboratory.

No QA/QC samples will be collected for soil remediation parameter samples except an MS/MSD sample for total organic carbon analysis.

Field duplicate and equipment rinsate samples will be collected for groundwater remediation parameter samples. MS/MSD samples will be collected only for total organic carbon and dissolved gases (methane, ethane, and ethene) analysis.

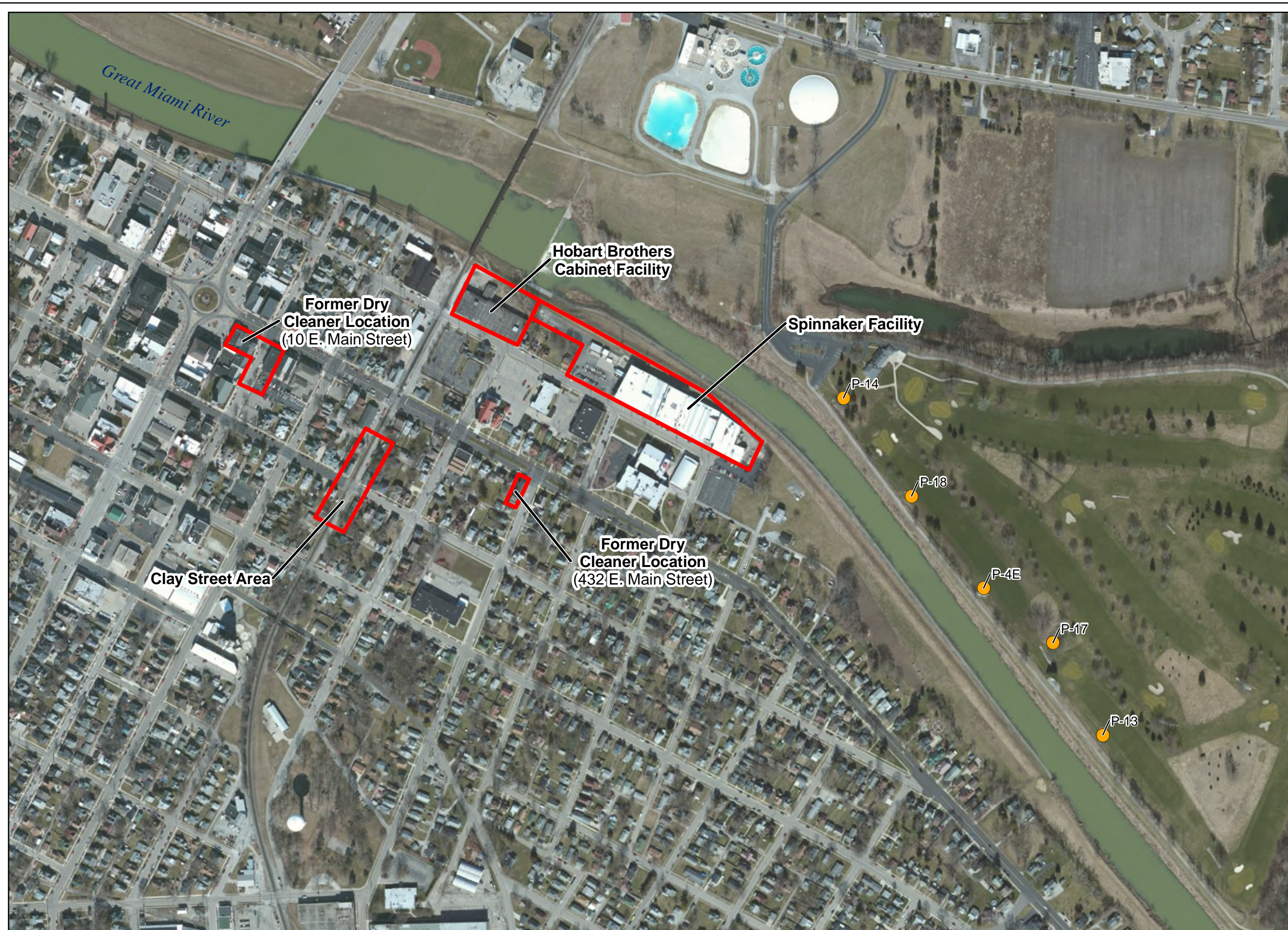
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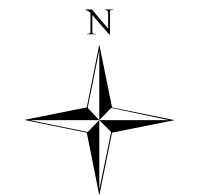
FIGURES

(12 Sheets)



Legend

-  Troy Production Well
-  Known or Suspected Source Area



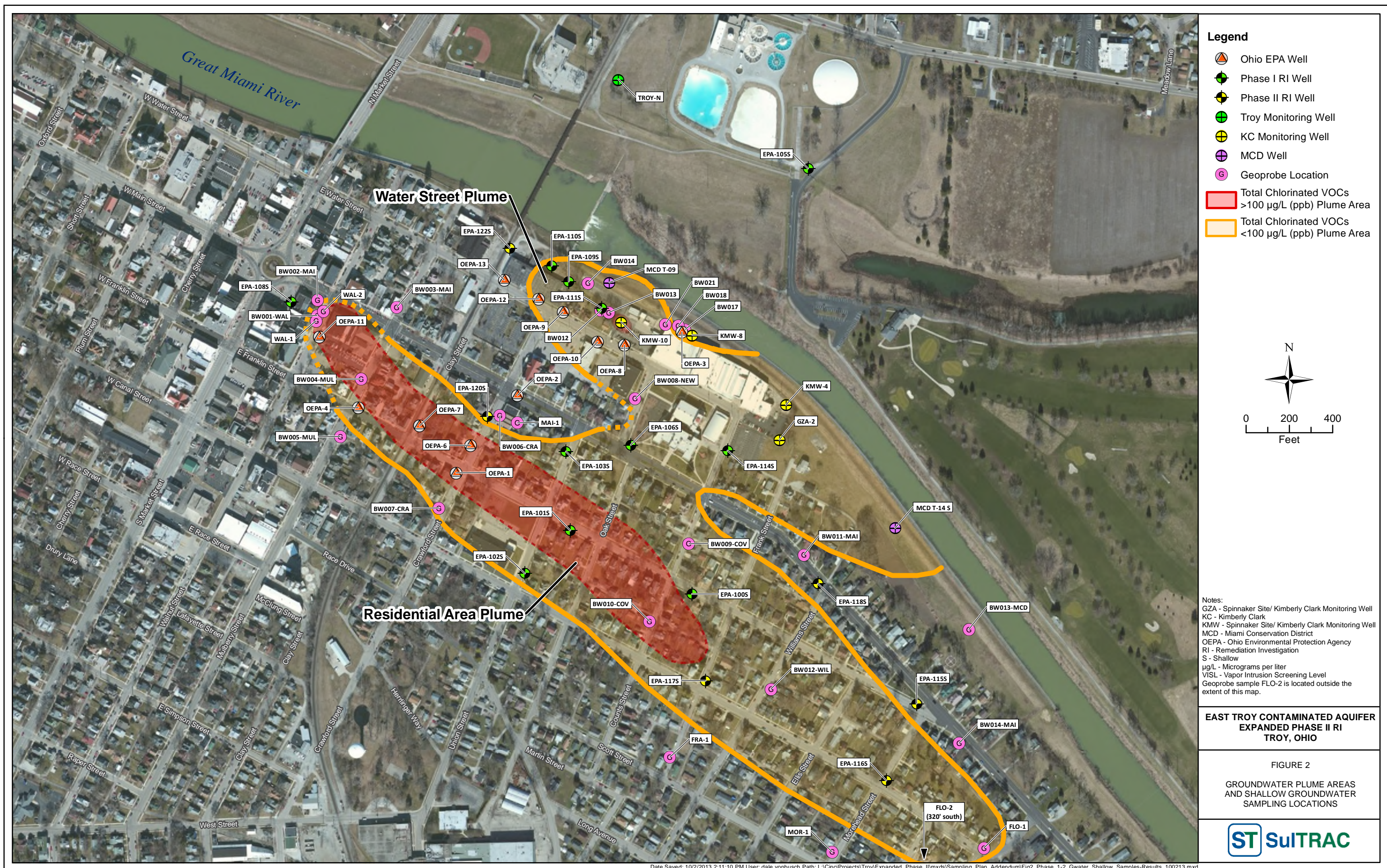
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**EAST TROY CONTAMINATED AQUIFER
EXPANDED PHASE II RI
TROY, OHIO**

FIGURE 1
SITE LOCATION AND
KNOWN OR SUSPECTED
SOURCE AREAS







Legend
Historic Sampling Locations

- Phase I Screening Sample from Direct Push Boring
- Phase I Soil Sample (May-June, 2012)
- Phase II Soil Sample (February, 2013)
- Ohio EPA Well
- Phase I RI Well
- Phase II RI Well
- Troy Monitoring Well
- Geoprobe Location

Total Chlorinated VOCs >100 µg/L (ppb) Plume Area

Total Chlorinated VOCs <100 µg/L (ppb) Plume Area

Exceeds EPA VISL

Exceeds EPA MCL

Exceeds both MCL & VISL

cis-1,2-DCE detected above reporting limit

Notes:
D - Deep
HRSC - High Resolution Site Characterization
I - Intermediate
MCL - Maximum Contaminant Level
MIP - Membrane interface probe
OEPA - Ohio Environmental Protection Agency
RI - Remediation Investigation
S - Shallow
µg/L - Micrograms per liter
µg/kg - Micrograms per kilogram
VISL - Vapor Intrusion Screening Level
Groundwater sample concentrations in µg/L.
Soil sample concentrations in µg/kg.

**EAST TROY CONTAMINATED AQUIFER
EXPANDED PHASE II RI
TROY, OHIO**

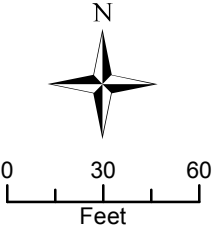
FIGURE 3
10 E MAIN AND GROUNDWATER PLUME
INVESTIGATION AREAS
RI PHASE I & II GROUNDWATER AND
SOIL SAMPLING RESULTS



Legend

Historic Sampling Locations

- Ohio EPA Well
- Phase I RI Well
- Phase II RI Well
- Geoprobe



- Exceeds EPA VISL
- Exceeds EPA MCL
- Exceeds both MCL & VISL
- cis-1,2-DCE detected above reporting limit

Notes:
D - Deep
HRSC - High Resolution Site Characterization
MCL - Maximum Contaminant Level
MIP - Membrane interface probe
OEPA - Ohio Environmental Protection Agency
RI - Remediation Investigation
S - Shallow
VISL - Vapor Intrusion Screening Level
µg/L - Micrograms per liter
Groundwater sample concentrations in µg/L.

**EAST TROY CONTAMINATED AQUIFER
EXPANDED PHASE II RI
TROY, OHIO**

FIGURE 4
432 E MAIN INVESTIGATION AREA
RI PHASE I & II GROUNDWATER
AND SOIL SAMPLING RESULTS



Legend

Historic Sampling Locations

- Phase I Screening Sample from Direct Push Boring
- Phase I Soil Sample (May-June, 2012)
- Phase II Soil Sample (February, 2013)
- Ohio EPA Well
- Phase I RI Well
- Phase II RI Well
- Geoprobe

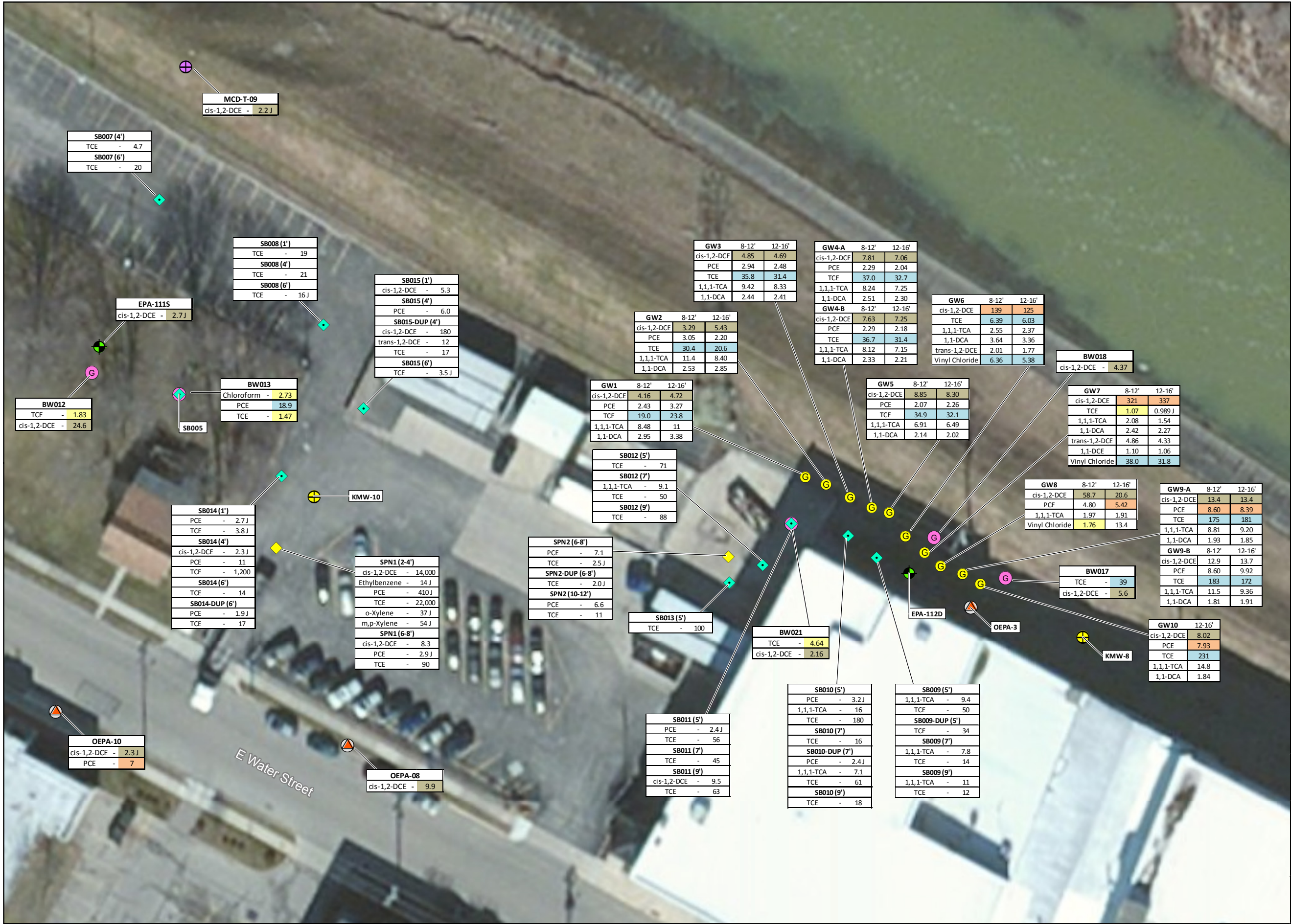
0 20 40 Feet

Exceeds EPA VISL
Exceeds EPA MCL
Exceeds both MCL & VISL
cis-1,2-DCE detected above reporting limit

Notes:
D - Deep
GZA - Spinnaker Site/Kimberly Clark Monitoring Well
ETCA - East Troy Contaminated Aquifer
HRSC - High Resolution Site Characterization
KC - Kimberly Clark
KMW - Spinnaker Site/Kimberly Clark Monitoring Well
MCD - Miami Conservancy District
MCL - Maximum Contaminant Level
MIP - Membrane interface probe
OEPA - Ohio Environmental Protection Agency
RI/FS - Remediation Investigation/Feasibility Study
S - Shallow
T - Miami Conservancy District Monitoring Well
VISL - Vapor Intrusion Screening Level
µg/L - Micrograms per liter
µg/kg - Micrograms per kilogram
Groundwater sample concentrations in µg/L.
Soil sample concentrations in µg/kg.

**EAST TROY CONTAMINATED AQUIFER
EXPANDED PHASE II RI
TROY, OHIO**

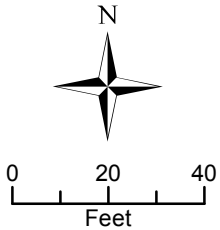
**FIGURE 5
HOBART INVESTIGATION AREA
RI PHASE I & II GROUNDWATER AND
SOIL SAMPLING RESULTS**



Legend

Historic Sampling Locations

- OEPA 2007 Geoprobe Location (data provided by OEPA)
- Phase I Soil Sample (May-June, 2012)
- Phase II Soil Sample (February, 2013)
- Ohio EPA Well
- Phase I RI Well
- Phase II RI Well
- KC Monitoring Well
- MCD Well
- Geoprobe

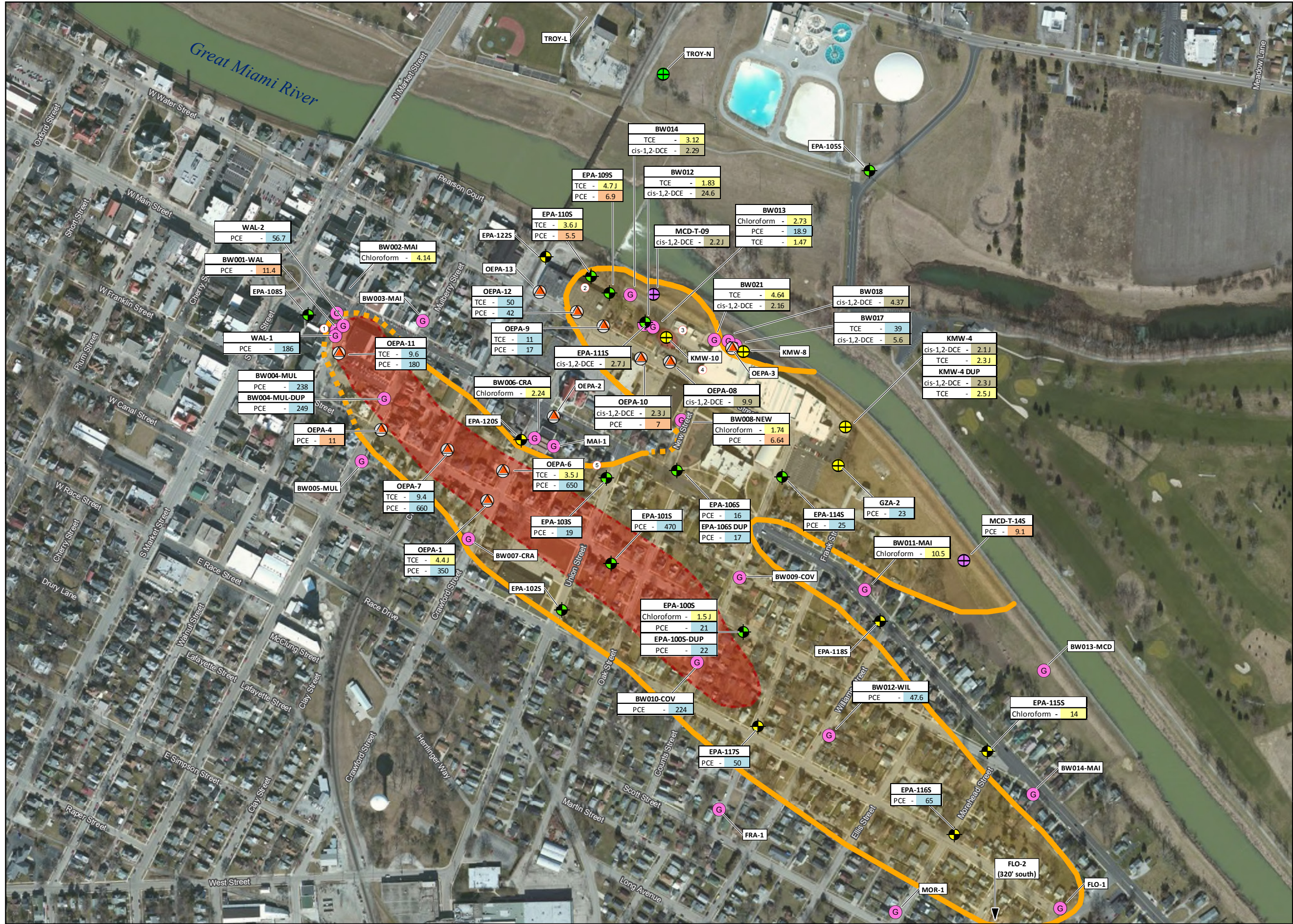


- Exceeds EPA VISL
- Exceeds EPA MCL
- Exceeds both MCL & VISL
- cis-1,2-DCE detected above reporting limit

Notes:
HRSC - High Resolution Site Characterization
KC - Kimberly Clark
KMW - Spinnaker Site/Kimberly Clark Monitoring Well
MCD - Miami Conservancy District
MCL - Maximum Contaminant Level
MIP - Membrane interface probe
OEPA - Ohio Environmental Protection Agency
RI - Remediation Investigation
S - Shallow
T - Miami Conservancy District Monitoring Well
VISL - Vapor Intrusion Screening Level
µg/L - Micrograms per liter
µg/kg - Micrograms per kilogram
Groundwater sample concentrations in µg/L.
Soil sample concentrations in µg/kg.

**EAST TROY CONTAMINATED AQUIFER
EXPANDED PHASE II RI
TROY, OHIO**

**FIGURE 6
SPINNAKER INVESTIGATION AREA
RI PHASE I & II GROUNDWATER AND
SOIL SAMPLING RESULTS**



Legend

Historic Sampling Locations

- Ohio EPA Well
- Phase I RI Well
- Phase II RI Well
- Troy Monitoring Well
- KC Monitoring Well
- MCD Well
- Geoprobe Location
- Total Chlorinated VOCs >100 µg/L (ppb) Plume Area
- Total Chlorinated VOCs <100 µg/L (ppb) Plume Area

- Exceeds EPA VISL
- Exceeds EPA MCL
- Exceeds both MCL & VISL
- cis-1,2-DCE detected above reporting limit

Notes:
ETCA - East Troy Contaminated Aquifer
GZA - Spinnaker Site/ Kimberly Clark Monitoring Well
HRSC - High Resolution Site Characterization
KC - Kimberly Clark
KMW - Spinnaker Site/ Kimberly Clark Monitoring Well
MCD - Miami Conservation District
MCL - Maximum Contaminant Level
OEPA - Ohio Environmental Protection Agency
RI/FS - Remediation Investigation/Feasibility Study
S - Shallow
T - Miami Conservancy District Monitoring Well
VAS - Vertical Aquifer Sample
VISL - Vapor Intrusion Screening Level
µg/L - Micrograms per liter
Groundwater sample concentrations in µg/L
Geoprobe sample FLO-2 is located outside the extent of this map.

**EAST TROY CONTAMINATED AQUIFER
EXPANDED PHASE II RI
TROY, OHIO**

**FIGURE 7
RI PHASE II
GROUNDWATER SAMPLING RESULTS**



Legend
Expanded Phase II Sampling Locations

- Indoor Air/Sub-Slab Vapor & Ambient Air Sampling
- HRSC Groundwater Profiling

Historic Sampling Locations

- Phase I Screening Sample from Direct Push Boring
- Phase I Soil Sample (May-June, 2012)
- Phase II Soil Sample (February, 2013)
- Ohio EPA Well
- Phase I RI Well
- Phase II RI Well
- Troy Monitoring Well
- Geoprobe Location

- Total Chlorinated VOCs >100 µg/L (ppb) Plume Area
- Total Chlorinated VOCs <100 µg/L (ppb) Plume Area

04080

Feet

Exceeds EPA VISL

Exceeds EPA MCL

Exceeds both MCL & VISL

cis-1,2-DCE detected above reporting limit

Notes:

D - Deep

HRSC - High ResolutionSite Characterization

I - Intermediate

MCL - Maximum Contaminant Level

MIP - Membrane interface probe

OEPA - Ohio Environmental Protection Agency

RI - Remediation Investigation

S - Shallow

µg/L - Micrograms per liter

µg/kg - Micrograms per kilogram

VISL - Vapor Intrusion Screening Level

Groundwater sample concentrations in µg/L.

Soil sample concentrations in µg/kg.

EAST TROY CONTAMINATED AQUIFER
EXPANDED PHASE II RI
TROY, OHIO

FIGURE 8

10 E MAIN AND GROUNDWATER PLUME INVESTIGATION AREAS

RI PHASE I & II GROUNDWATER AND SOIL SAMPLING RESULTS AND EXPANDED PHASE II SAMPLING LOCATIONS

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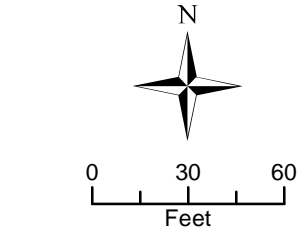
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Expanded Phase II Sampling Locations

- S Surface Soil Sampling
- S Sub-Slab Surface and Subsurface Soil Sampling
- ▲ Indoor Air/Sub-Slab Vapor & Ambient Air Sampling
- ⊕ HRSC Groundwater Profiling

Historic Sampling Locations

- ⊕ Ohio EPA Well
- ⊕ Phase I RI Well
- ⊕ Phase II RI Well
- G Geoprobe



- Exceeds EPA VISL
- Exceeds EPA MCL
- Exceeds both MCL & VISL
- cis-1,2-DCE detected above reporting limit

Notes:
D - Deep
HRSC - High Resolution Site Characterization
MCL - Maximum Contaminant Level
MIP - Membrane interface probe
OEPA - Ohio Environmental Protection Agency
RI - Remediation Investigation
S - Shallow
VISL - Vapor Intrusion Screening Level
µg/L - Micrograms per liter
Groundwater sample concentrations in µg/L.

**EAST TROY CONTAMINATED AQUIFER
EXPANDED PHASE II RI
TROY, OHIO**

FIGURE 9
432 E MAIN INVESTIGATION AREA
RI PHASE I & II GROUNDWATER
AND SOIL SAMPLING RESULTS AND
EXPANDED PHASE II
SAMPLING LOCATIONS





Legend
Expanded Phase II Sampling Locations

- S Surface Soil Sampling
- S Sub-Slab Surface and Subsurface Soil Sampling
- G Geoprobe Surface and Subsurface Soil Sampling
- + HRSC Groundwater Profiling

Historic Sampling Locations

- X Phase I Screening Sample from Direct Push Boring
- ◆ Phase I Soil Sample (May-June, 2012)
- ◆ Phase II Soil Sample (February, 2013)
- Ohio EPA Well
- Phase I RI Well
- Phase II RI Well
- Geoprobe

N

0

20

40

Feet

Exceeds EPA VISL

Exceeds EPA MCL

Exceeds both MCL & VISL

cis-1,2-DCE detected above reporting limit

Notes:
D - Deep
GZA - Spinnaker Site/Kimberly Clark Monitoring Well
ETCA - East Troy Contaminated Aquifer
HRSC - High Resolution Site Characterization
KC - Kimberly Clark
KMW - Spinnaker Site/Kimberly Clark Monitoring Well
MCD - Miami Conservancy District
MCL - Maximum Contaminant Level
MIP - Membrane interface probe
OEPA - Ohio Environmental Protection Agency
RI/FS - Remediation Investigation/Feasibility Study
S - Shallow
T - Miami Conservancy District Monitoring Well
VISL - Vapor Intrusion Screening Level
µg/L - Micrograms per liter
µg/kg - Micrograms per kilogram
Groundwater sample concentrations in µg/L.
Soil sample concentrations in µg/kg.

**EAST TROY CONTAMINATED AQUIFER
EXPANDED PHASE II RI
TROY, OHIO**

FIGURE 10
HOBART INVESTIGATION AREA
RI PHASE I & II GROUNDWATER AND
SOIL SAMPLING RESULTS AND
EXPANDED PHASE II
SAMPLING LOCATIONS

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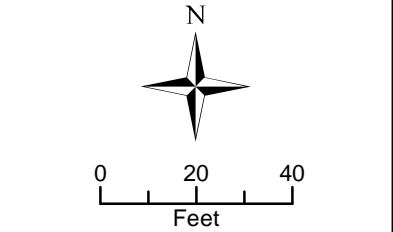
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Expanded Phase II Sampling Locations

- Surface Soil Sampling
- Sub-Slab Surface and Subsurface Soil Sampling
- Geoprobe Surface and Subsurface Soil Sampling
- HRSC Groundwater Profiling

Historic Sampling Locations

- OEPA 2007 Geoprobe Location (data provided by OEPA)
- Phase I Soil Sample (May-June, 2012)
- Phase II Soil Sample (February, 2013)
- Ohio EPA Well
- Phase I RI Well
- Phase II RI Well
- KC Monitoring Well
- MCD Well
- Geoprobe



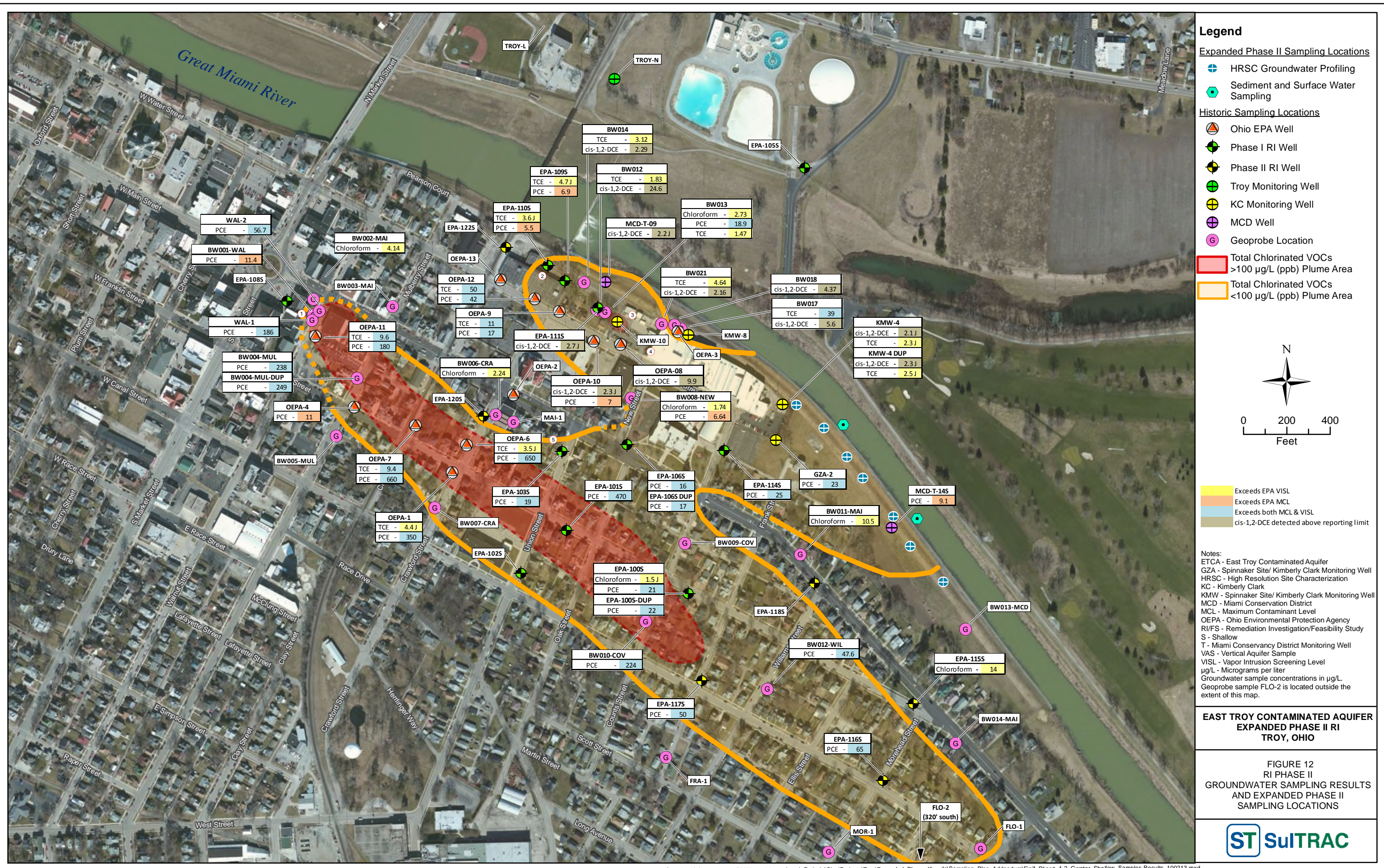
- Exceeds EPA VISL
- Exceeds EPA MCL
- Exceeds both MCL & VISL
- cis-1,2-DCE detected above reporting limit

Notes:
HRSC - High Resolution Site Characterization
KC - Kimberly Clark
KMW - Spinnaker Site/Kimberly Clark Monitoring Well
MCD - Miami Conservation District
MCL - Maximum Contaminant Level
MIP - Membrane interface probe
OEPA - Ohio Environmental Protection Agency
RI - Remediation Investigation
S - Shallow
T - Miami Conservancy District Monitoring Well
VISL - Vapor Intrusion Screening Level
µg/L - Micrograms per liter
µg/kg - Micrograms per kilogram
Groundwater sample concentrations in µg/L.
Soil sample concentrations in µg/kg.

**EAST TROY CONTAMINATED AQUIFER
EXPANDED PHASE II RI
TROY, OHIO**

FIGURE 11
SPINNAKER INVESTIGATION AREA
RI PHASE I & II GROUNDWATER AND
SOIL SAMPLING RESULTS AND
EXPANDED PHASE II
SAMPLING LOCATIONS





**REMEDIAL ACTION CONTRACT 2 FOR
REMEDIAL, ENFORCEMENT OVERSIGHT, AND
NON-TIME-CRITICAL REMOVAL ACTIVITIES
IN REGION 5**

ATTACHMENT B

**EXPANDED PHASE II QUALITY ASSURANCE PROJECT PLAN
EAST TROY CONTAMINATED AQUIFER SITE
TROY, MIAMI COUNTY, OHIO**

**Prepared for
U.S. Environmental Protection Agency
Region 5
77 West Jackson Boulevard
Chicago, IL 60604**

Date Submitted:	November 6, 2013
U.S. EPA Region:	5
Work Assignment No:	145-RICO-B5EN
Contract No:	EP-S5-06-02
Prepared by:	SulTRAC
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CONTENTS

<u>Section</u>	<u>Page</u>
ACRONYMS AND ABBREVIATIONS	iii
1.0 INTRODUCTION	1
2.0 SITE BACKGROUND, DATA GAPS, AND EXPANDED PHASE II APPROACH	1
QAPP Worksheet #1 Title and Approval Page	7
QAPP Worksheet #2 QAPP Identifying Information	8
QAPP Worksheet #3 Distribution List.....	14
QAPP Worksheet #4 Project Personnel Sign-Off Sheet	15
QAPP Worksheet #5 Project Organization Chart	16
QAPP Worksheet #6 Communication Pathways	17
QAPP Worksheet #7 Personnel Responsibilities and Qualifications Table	18
QAPP Worksheet #8 Special Personnel Training Requirements Table.....	19
QAPP Worksheet #9 Project Scoping Session Participants Sheet.....	20
QAPP Worksheet #10 Problem Definition	25
QAPP Worksheet #11 Project Quality Objectives/Systematic Planning Process Statements	29
QAPP Worksheet #12 Measurement Performance Criteria Table.....	32
QAPP Worksheet #13 Secondary Data Criteria and Limitations Table	41
QAPP Worksheet #14 Summary of Project Tasks.....	42
QAPP Worksheet #15 Reference Limits and Evaluation Table	44
QAPP Worksheet #16 Project Schedule/Timeline Table.....	46
QAPP Worksheet #17 Sampling Design and Rationale	47
QAPP Worksheet #18 Sampling Locations/IDs, Sample Depths, Sample Analyses and Sampling Procedures Table.....	51
QAPP Worksheet #19 Analytical Methods, Containers, Preservatives, and Holding Times Table	54
QAPP WORKSHEET #20 C Field Quality Control Sample Summary Table for Source Characterization Activities	56
QAPP WORKSHEET #20 RP Field Quality Control Sample Summary Table for Remediation Parameter Sampling Activities.....	59
QAPP Worksheet #21 Project Sampling SOP References Table	62
QAPP Worksheet #22 Field Equipment Calibration, Maintenance, Testing, and Inspection Table.....	64
QAPP Worksheet #23 Analytical SOP References Table	65
QAPP Worksheet #24 Analytical Instrument Calibration Table	67
QAPP Worksheet #25 Analytical Instrument and Equipment Maintenance Testing, and Inspection Table	69
QAPP Worksheet #26 Sample Handling System	71
QAPP Worksheet #27 Sample Custody Requirements.....	72
QAPP Worksheet #28 QC Samples Table	74
QAPP Worksheet #29 Project Documents and Records Table.....	83
QAPP Worksheet #30 Analytical Services Table.....	84

CONTENTS (Continued)

<u>Section</u>	<u>Page</u>
QAPP Worksheet #31 Planned Project Assessments Table	85
QAPP Worksheet #32 Assessment Findings and Corrective Action Responses	86
QAPP Worksheet #33 QA Management Reports Table	87
QAPP Worksheet #34 Verification (Step I) Process Table	88
QAPP Worksheet #35 Validation (Steps IIa and IIb) Process Table	89
QAPP Worksheet #36 Validation (Steps IIa and IIb) Summary Table.....	90
QAPP Worksheet #37 Usability Assessment.....	91
REFERENCES	93

ACRONYMS AND ABBREVIATIONS

%D	Percent difference
%R	Percent recovery
µg/L	Micrograms per liter
µm	Micrometer
ASTM	American Society for Testing and Materials (now ASTM International)
bgs	Below ground surface
BTEX	Benzene, toluene, ethylbenzene, and xylene
CA	Corrective action
CADRE	Computer-aided data review and evaluation
CAS	Chemical Abstract Services
CCV	Continuing calibration verification
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CF	Calibration factor
CLP	Contract Laboratory Program
COC	Chain of custody
CRQL	Contract-required quantitation limit
DAT	Data assessment tool
DCA	Dichloroethane
DCE	Dichloroethene
DQI	Data quality indicator
EPA	U.S. Environmental Protection Agency
FS	Feasibility study
FSP	Field sampling plan
GC	Gas chromatography
HAZWOPER	Hazardous Waste Operations and Emergency Response Standard
HCl	Hydrochloric acid
HDPE	High-density polyethylene
HRSC	High resolution site characterization

ACRONYMS AND ABBREVIATIONS (CONTINUED)

ID	Identification
K-C	Kimberly-Clark, Inc.
LIMS	Laboratory information management system
MCL	Maximum contaminant level
MIP	Membrane interface probe
mL	Milliliter
MS	Matrix spike
MSD	Matrix spike duplicate
NA	Not applicable
NC	No criteria
ND	Not detected
NELAP	National Environmental Laboratory Accreditation Program
NFG	National Functional Guidelines
Ohio EPA	Ohio Environmental Protection Agency
ORP	Oxidation-reduction potential
OSHA	Occupational Safety and Health Administration
PCE	Tetrachloroethene
PID	Photoionization detector
ppb	Parts per billion
PTFE	Polytetrafluoroethylene
QA	Quality assurance
QAPP	Quality assurance project plan
QC	Quality control
QL	Quantitation limit
RAC	Remedial Action Contract
RI	Remedial investigation
RP	Remediation parameter
RPD	Relative percent difference
RSCC	Regional Sample Control Coordinator
SAP	Sampling and analysis plan
SOP	Standard operating procedure
SOW	Statement of work

ACRONYMS AND ABBREVIATIONS (CONTINUED)

TBD	To be determined
TCA	Trichloroethane
TCE	Trichloroethene
TDS	Total dissolved solids
TOC	Total organic carbon
UFP	Uniform Federal Policy for Implementing Environmental Quality Systems
VAS	Vertical aquifer sampling
VI	Vapor intrusion
VISL	Vapor intrusion screening level
VOC	Volatile organic compound
WA	Work assignment
WAM	Work assignment manager

1.0 INTRODUCTION

SulTRAC has prepared this expanded Phase II remedial investigation (RI) quality assurance project plan (QAPP) as part of the sampling and analysis plan (SAP) to supplement the Phase I SAP and Vapor Intrusion Monitoring Program SAP addendum for the East Troy Contaminated Aquifer Site (East Troy site) in Troy, Miami County, Ohio (see Figure 1) (SulTRAC 2010 and 2011). This QAPP was prepared under the U.S. Environmental Protection Agency (EPA) Remedial Action Contract (RAC) II for Region 5, Contract No. EP-S5-06-02, Work Assignment (WA) No. 145-RICO-B5EN. The purpose of this QAPP is to specifically address quality assurance (QA) and quality control (QC) protocols and objectives, methods, and procedures to be performed by SulTRAC during the expanded Phase II field investigation. Data gathered during the Phase I and initial Phase II investigations were used to develop an approach for the expanded Phase II RI. In addition, SulTRAC will conduct a membrane interface probe (MIP) investigation prior to the expanded Phase II RI activities included in this SAP. The scope and procedures of the MIP investigation are detailed in a MIP investigation sampling plan (SulTRAC 2013). MIP is a high resolution site characterization (HRSC) technique that will be used to obtain a higher density of screening level data at the suspected source areas. The results of the MIP investigation will likely alter the number and locations of soil and groundwater samples collected as part of this expanded Phase II RI. Therefore, the sample numbers and locations presented in this SAP are estimates, and actual numbers and locations may vary.

Expanded Phase II RI activities include: (1) further characterizing potential source areas to delineate the extent of contamination and facilitate evaluation of remedial alternatives in the feasibility study (FS), (2) obtaining indoor air samples at suspected source areas not previously sampled in Phases I or II, (3) evaluating potential secondary source areas within groundwater plume hot spots that may be associated with contaminants sorbed to fine-grained materials, and (4) filling other data gaps identified during the Phase II RI. The complete scope of the expanded Phase II field investigation is presented in this QAPP; however, specific QA/QC protocols and objectives, methods, and procedures for investigation activities detailed in previous East Troy site QAPPs are not presented in this report. Instead, the Phase I SAP (SulTRAC 2010) and Vapor Intrusion Monitoring Program SAP addendum (SulTRAC 2011) are referenced where appropriate.

2.0 SITE BACKGROUND, DATA GAPS, AND EXPANDED PHASE II APPROACH

Since 1988, volatile organic compounds (VOC) have been detected in the City of Troy's East Wellfield, a municipal drinking water wellfield located approximately 0.25 mile and across the Great Miami River from an identified VOC plume area. Cis-1,2-dichloroethene (cis-1,2-DCE) is the compound detected most frequently in the East Wellfield. The chlorinated VOCs tetrachloroethene (PCE), trichloroethene (TCE), and cis-1,2-DCE have been detected in samples from production wells in the West Wellfield.

However, the sources of contamination in each wellfield are currently believed to differ. This RI/FS addresses only the area of contamination affecting the East Wellfield.

SulTRAC conducted the Phase I RI between August 2010 and June 2012. Phase I included drilling and installation of groundwater monitoring wells; installation of soil borings with soil and groundwater sampling; a vertical aquifer sampling (VAS) program; a camera investigation of the sanitary sewer system; groundwater sampling; sediment and surface water sampling in the Great Miami River; and a vapor intrusion monitoring program.

SulTRAC conducted initial Phase II RI activities between August 2012 and April 2013. Phase II included resampling of some Phase I vapor intrusion sampling locations, collecting groundwater elevation measurements, additional VAS and monitoring well installation, a second comprehensive groundwater sampling event, collecting soil samples and shallow groundwater screening samples, and additional vapor intrusion sampling. In addition, a site visit focused on evaluating potential source areas was conducted by SulTRAC, EPA, and Ohio EPA in July 2013.

RI data collected to date has identified the following two groundwater plume areas:

1. Residential Area Plume
2. Water Street Plume

Concentrations of PCE and TCE exceeding maximum contaminant levels (MCL) and vapor intrusion screening levels (VISL) are present in both plume areas. Cis-1,2-DCE has been detected most frequently in the Water Street Plume at concentrations below maximum contaminant levels (MCLs) and VISLs. Groundwater contaminant concentrations in these plume areas have not decreased over time, indicating that continuing sources may exist at the primary potential source areas. Alternatively, residual VOCs may be sorbed to fine-grain subsurface material or in the zone of groundwater fluctuation, resulting in an ongoing secondary source of contamination. The primary purpose of this expanded Phase II RI is to determine if additional potential source areas exist and to further delineate the primary potential source areas identified.

Residential Area Plume Source Areas

Three potential source areas have been identified within the Residential Plume Area: (1) a former dry cleaner at 10 East Main Street, (2) a former dry cleaner at 432 East Main Street, and (3) a potential secondary source in the vicinity of Clay and Franklin Streets. The Residential Area Plume originates in the vicinity of the former dry cleaner located at 10 East Main Street and stretches southeast for nearly $\frac{3}{4}$ mile to Floral Avenue. The building that housed the former dry cleaner and the adjacent structure to the east at 12 East Main Street were reportedly demolished to make room for the addition to the First Presbyterian Church constructed in the 1990s. The original structure at 10 East Main reportedly had no basement. The basement floor of the present structure sits approximately 6 to 7 feet below sidewalk

level, indicating that at least the uppermost 7 feet of soil was excavated and removed during construction of the church addition. During the recent site reconnaissance on July 2 and 3, 2013, no additional source areas were identified. However, it is unknown whether source material remains beneath the church building addition. An additional former dry cleaner has been identified within the plume area at 432 East Main Street. One groundwater sample collected downgradient of this location contained moderate concentrations of PCE. Finally, an area of consistently elevated PCE and TCE groundwater concentrations located in the vicinity of Clay and Franklin Streets indicates that a secondary source area may exist. No primary sources have been identified in this area.

Subsurface soil samples may be collected at the 10 East Main Street Residential Plume potential source area if MIP investigation results indicate that soil contamination is present in this area. At 432 East Main, two sub-slab soil samples will be collected indoors near a floor drain that may have been used to dispose of dry cleaning fluids. In addition, two surface soil samples will be collected outdoors near exhaust fans.

SulTRAC will conduct HRSC direct-push multilevel groundwater profiling at the Residential Area Plume potential source areas to determine if additional primary or secondary source material exists in the vicinity of the potential source areas. Secondary source material could include contaminants sorbed to lower permeability deposits or within the zone of groundwater fluctuation. The HRSC groundwater profiling will also evaluate associated contaminant release and transport mechanisms. Groundwater samples collected will be analyzed on site for target VOCs using a mobile laboratory for fast turnaround. Mobile laboratory results may be used to guide or modify subsequent HRSC sampling locations. HRSC groundwater profiling will also provide detailed data relative to the distribution of hydraulic conductivity and hydraulic head, pH, specific conductance, dissolved oxygen, and oxidation reduction potential (ORP) to correlate VOC concentrations with these other parameters.

Furthermore, the leading edge of the Residential Area Plume is currently defined by temporary monitoring points. A new permanent well will be installed and sampled for effective long-term monitoring the plume's leading edge.

Water Street Plume Source Areas

The Phase I and initial Phase II RI identified existing primary potential source areas of contaminated soil within the Water Street Plume area at Hobart Cabinet Company (Hobart) located at 301 East Water Street and Spinnaker Coating, LLC (Spinnaker), located at 518 East Water Street. At Hobart, significant concentrations of chlorinated solvents and associated daughter products (PCE, TCE, 1,1,2-trichloroethane [1,1,2-TCA], and DCE) and other VOCs (benzene, ethylbenzene, and xylene) have been detected in soil in the loading dock area. Soil contamination was detected in both shallow (1 to 4 feet below ground surface [bgs]) and deep (10 to 12 feet bgs) soil indicating that surface disposal or spillage likely occurred; however, no specific sources have been identified. In addition, the on-site source investigation identified

the location of a former vapor degreaser inside the central portion of the building, which may be an additional potential source of on-site soil and groundwater contamination.

At Spinnaker, RI data, 2007 Geoprobe groundwater data (Ohio EPA 2007) from Ohio EPA and data from investigations conducted by the former site owner, Kimberly-Clark Corporation (Shaw 2006), have delineated wide-spread shallow and deep (1 to 12 feet bgs) soil contamination throughout the west parking lot area and outside the northwestern corner of the Spinnaker building, as well as groundwater contamination throughout the site. Contaminants detected in soil or groundwater include chlorinated solvents and associated daughter products (PCE, TCE, cis-1,2-DCE, 1,1,1-trichloroethane [1,1,1-TCA], dichloroethane [DCA], and vinyl chloride) and other VOCs (benzene, toluene, ethylbenzene, and xylene [BTEX]). Previous potential sources identified in the west parking lot area include a former material and waste storage area, including a former bulk storage area, former hazardous waste area, and a former 300-gallon gasoline underground storage tank. One additional potential source area is a former dry cleaner located in the southeastern portion of the west parking lot. However, shallow soil contamination exists throughout the west parking lot outside of these former potential source areas, including in the vicinity of Spinnaker monitoring well KMW-10, which is located at the western site fence, at a depth of 2 to 4 feet bgs. Groundwater samples from Spinnaker monitoring well KMW-10, located at the western (upgradient) site boundary have historically contained the highest reported concentrations of VOCs at the site, with cis-1,2-DCE concentrations ranging as high as over 100 µg/L. However, no known historic manufacturing operations or other obvious sources of this contamination have yet been identified in this area and none were observed during the July 2013 site reconnaissance.

An additional area of soil and groundwater contamination has been identified outside the northwestern corner of the Spinnaker building near a former nonhazardous waste storage area, which was used to store empty drums and nonhazardous adhesive materials. Shallow soil and groundwater contamination is also present between the northwest corner of the building and the levee. Elevated concentrations of TCE, 1,1,1-TCA, and cis-1,2-DCE in soil (5 to 9 feet bgs) were also detected near the northwest corner of the main building during the initial Phase II RI. Elevated concentrations of PCE, TCE, 1,1,1-TCA, cis-1,2-DCE, DCA, and vinyl chloride have been detected in groundwater near the northwest corner of the main building. However, no known historic manufacturing operations or other obvious sources of this contamination have yet been identified between the building and the levee and none were observed during the July 2013 site reconnaissance.

Another potential area of concern within the Water Street Plume is the area southeast of Spinnaker adjacent to the Great Miami River, which is directly across the river from the City of Troy production well where cis-1,2-DCE has been detected. It is unclear if and where groundwater contamination may be migrating under the river toward the production well.

Surface and subsurface soil samples will be collected at the Water Street Plume to delineate the nature and extent of contamination at potential source areas. A total of 28 surface soil samples will be collected at 25 locations at the Hobart and Spinnaker potential source areas. A total of 40 subsurface soil samples will be collected from 18 locations at the Hobart and Spinnaker potential source areas.

SulTRAC will also conduct HRSC direct-push multilevel groundwater profiling at the Water Street Plume potential source areas, as well as the area southeast of Spinnaker.

Other Areas of Investigation

In addition to the groundwater and soil contamination, elevated levels of PCE, TCE, and cis-1,2-DCE were detected in soil gas and indoor air of structures within the groundwater plume areas during the Phase I and initial Phase II RI. However, indoor air or soil gas samples were not collected at suspected source areas located at 10 East Main Street or 432 East Main Street because of access restrictions. Therefore, SulTRAC will collect seven sub-slab vapor and indoor air samples and three ambient air samples from 10 East Main Street and 432 East Main Street.

Four surface water and sediment samples were collected from the Great Miami River during Phase I; however, no samples were collected south of the Spinnaker property. Since then, the Water Street Plume has been found to extend as far south as Ellis Street, about 900 feet south of the Spinnaker property. SulTRAC will collect four sediment and surface water samples from two locations in the Great Miami River to evaluate whether the groundwater plume is affecting the river southeast of Spinnaker.

Soil and groundwater samples will be collected to facilitate evaluation of remedial alternatives in the FS. Soil parameters will evaluate the potential effectiveness of in-situ remediation technologies in saturated and unsaturated zones. Soil remediation parameters include total organic carbon, grain size/particle size distribution, hydraulic conductivity, soil permeability, bulk soil density, and porosity. Residential plume area soil remediation parameter sample locations are located near monitoring wells EPA-107I and OEPA-7, where the highest PCE concentrations have historically been detected. Spinnaker area soil remediation parameter samples will be collected from one soil boring near the former chemical storage area near the center of the parking lot from each of the three strata that underlie the site.

Groundwater remediation parameters will evaluate the effectiveness of natural attenuation and other in situ remediation technologies. Groundwater remediation parameters include anions (chloride, sulfate, nitrate, fluoride, and bromide), ferrous iron, dissolved gases (methane, ethane, and ethene), total organic carbon, alkalinity, and total dissolved solids. In addition, the following groundwater field parameters will be collected from each well where remediation parameter sampling will be conducted: temperature, pH, specific conductance, dissolved oxygen, and ORP. Groundwater remediation parameter sample locations in the residential plume area are monitoring wells EPA-107I, EPA-116S, and OEPA-7. These wells are located in the western, central, and eastern portions of the Residential Area Groundwater Plume.

Furthermore, the highest PCE concentrations have historically been detected at wells EPA-107I and OEPA-7. Hobart area groundwater remediation parameter samples will be collected from monitoring well EPA-110S, located near the center of the property. Spinnaker area groundwater remediation parameter samples will be collected from monitoring wells OEPA-3 and KMW-10. Elevated contaminant concentrations have been detected in both locations. VOC analysis will also be conducted at each of the groundwater remediation parameter locations to evaluate the relationship between remediation parameters and VOC contaminant concentrations. In addition, chloride analysis will be conducted for groundwater samples collected from upgradient monitoring wells EPA-108S and EPA-122S.

SulTRAC will collect three rounds of groundwater elevation measurements during the expanded Phase II investigation. These will include, at least one set of measurements concurrent with a period when the City of Troy is using at least one of each of the production wells in which low levels of VOCs have been detected. These include wells P-14, P-18 and P-17.

SulTRAC will also conduct elevation surveys at the newly installed monitoring wells, as well as, up to 20 Spinnaker monitoring wells that have not been previously surveyed by EPA. Finally, SulTRAC will survey residents regarding private well use because of anecdotal evidence of residents using hand-dug wells for irrigation.

**QAPP WORKSHEET #1
TITLE AND APPROVAL PAGE**

Quality Assurance Project Plan for Expanded Phase II Remedial Investigation/Feasibility Study, East Troy Site, Troy, Miami County, Ohio

Document Title

SulTRAC

Lead Organization

Kristine Schnoes, SulTRAC

Preparer's Name and Organizational Affiliation

1 South Wacker Drive, Chicago, IL 60606; (312) 201-7480; kris.schnoes@tetrattech.com

Preparer's Address, Telephone Number, and E-mail Address

November 6, 2013

Preparation Date (Day/Month/Year)

E sig and date

Guy Montfort

SulTRAC Project Manager

Signature/Date

E sig and date

John Dirgo

SulTRAC QA Officer

Signature/Date

Approval Signatures:

Signature/Date

Shari Kolak, Work Assignment Manager

Printed Name/Title

Signature/Date

Daniel Pittman, TestAmerica

Laboratory Director

Printed Name/Title

Approval Authority

Other Approval Signatures:

Signature/Date

Alida Roberman, EPA QAPP Reviewer

Printed Name/Title

Signature/Date

Madelyn Smith, Project Manager (Ohio EPA)

Printed Name/Title

QAPP WORKSHEET #2
QAPP IDENTIFYING INFORMATION

1. Identify guidance used to prepare QAPP:

“Uniform Federal Policy for Implementing Environmental Quality Systems” (UFP) (EPA 2005) and
“EPA Guidance for Quality Assurance Project Plans” (EPA 2002)

2. Identify regulatory program:

Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA)

3. Identify approval entity: EPA Region 5

4. Indicate whether the QAPP is a generic or project-specific QAPP: Project-specific

5. List dates of scoping sessions that were held: See Worksheet #9

6. List dates and titles of QAPP documents written for previous work site, if applicable:

“Sampling and Analysis Plan – Phase I Remedial Investigation/Feasibility Study, East Troy Contaminated Aquifer Superfund Site, Troy, Miami County, Ohio, Attachment B, Quality Assurance Project Plan.” Dated August 11, 2010.

“Sampling and Analysis Plan – Vapor Intrusion Monitoring Program, Remedial Investigation/Feasibility Study, East Troy Contaminated Aquifer Superfund Site, Troy, Miami County, Ohio, Attachment B, Quality Assurance Project Plan.” Dated December 9, 2011.

7. List organizational partners (stakeholders) and connection with lead organization:

EPA Region 5, SulTRAC, Ohio EPA

8. List data users: EPA Region 5, SulTRAC, Ohio EPA

9. If any required QAPP elements and required information are not applicable to the project, then circle the omitted QAPP elements and required information on the attached table. Provide an explanation for their exclusion below: No assessments are planned, so Worksheets 31 and 32 are not applicable.

QAPP WORKSHEET #2 (CONTINUED)
QAPP IDENTIFYING INFORMATION

Required QAPP Element(s) and Corresponding QAPP Section(s)	Required Information	QAPP Worksheet # or Crosswalk to Related Documents
Project Management and Objectives		
2.1 - Title and Approval Page	Title and Approval Page	1
2.2 - Document Format and Table of Contents	Table of Contents	
2.2.1 Document Control Format	QAPP Identifying Information	2
2.2.2 Document Control Numbering System		
2.2.3 Table of Contents		
2.2.4 QAPP Identifying Information		
2.3 - Distribution List and Project Personnel Sign-Off Sheet		
2.3.1 Distribution List	Distribution List	3
2.3.2 Project Personnel Sign-Off Sheet	Project Personnel Sign-Off Sheet	4
2.4 - Project Organization		
2.4.1 Project Organization Chart	Project Organization Chart	5
2.4.2 Communication Pathways	Communication Pathways	6
2.4.3 Personnel Responsibilities and Qualifications	Personnel Responsibilities and Qualifications	7
2.4.4 Special Training Requirements and Certification	Special Training Requirements and Certification	8
2.5 - Project Planning/Problem Definition		
2.5.1 Project Planning (Scoping)	Project Planning Session Documentation (including Data Needs tables)	9
	Project Scoping Session Participants Sheet	
2.5.2 Problem Definition, Site History, and Background	Problem Definition, Site History, and Background	10
	Site Maps (historical and present)	Figures 1 through 7 of Field Sampling Plan (Attachment A of this Sampling and Analysis Plan)

QAPP WORKSHEET #2 (CONTINUED)
QAPP IDENTIFYING INFORMATION

Required QAPP Element(s) and Corresponding QAPP Section(s)	Required Information	QAPP Worksheet # or Crosswalk to Related Documents
2.6 - Project Quality Objectives (PQO) and Measurement Performance Criteria		
2.6.1 Development of PQOs Using the Systematic Planning Process	Site-Specific PQOs	11
2.6.2 Measurement Performance Criteria	Measurement Performance Criteria Table	12
2.7 - Secondary Data Evaluation	Sources of Secondary Data and Information	13
	Secondary Data Criteria and Limitations Table	
2.8 - Project Overview and Schedule		
2.8.1 Project Overview	Summary of Project Tasks	14
	Reference Limits and Evaluation Table	15
2.8.2 Project Schedule	Project Schedule/Timeline Table	16
Measurement/Data Acquisition		
3.1 - Sampling Tasks		
3.1.1 Sampling Process Design and Rationale	Sampling Design and Rationale	17
	Sampling Location Map	18, Figures 8 through 12 of Field Sampling Plan (Attachment A of this Sampling and Analysis Plan)
	Sampling Locations and Methods/Standard Operating Procedures (SOP) Requirements Table	
3.1.2 Sampling Procedures and Requirements		
3.1.2.1 Sampling Collection Procedures	Field Quality Control Sample Summary Table	20
	Sampling SOPs	21
	Project Sampling SOP References Table	21
3.1.2.2 Sample Containers, Volume, and Preservation	Analytical Methods/SOP Requirements Table	19, 23
3.1.2.3 Equipment/Sample Containers Cleaning and Decontamination Procedures	Analytical Methods, Containers, Preservatives, and Holding Times Table	19

QAPP WORKSHEET #2 (CONTINUED)
QAPP IDENTIFYING INFORMATION

Required QAPP Element(s) and Corresponding QAPP Section(s)	Required Information	QAPP Worksheet # or Crosswalk to Related Documents
3.1.2.4 Field Equipment Calibration, Maintenance, Testing, and Inspection Procedures	Field Equipment, Calibration, Maintenance, Testing, and Inspection Procedures Table	22
3.1.2.5 Supply Inspection and Acceptance Procedures		
3.1.2.6 Field Documentation Procedures		
3.2 - Analytical Tasks		
3.2.1 Analytical SOPs	Analytical SOPs	23
	Analytical SOP References Table	
3.2.2 Analytical Instrument Calibration Procedures	Analytical Instrument Calibration Table	24
3.2.3 Analytical Instrument and Equipment Maintenance, Testing, and Inspection Procedures	Analytical Instrument and Equipment Maintenance, Testing, and Inspection Table	25
3.2.4 Analytical Supply Inspection and Acceptance Procedures		
3.3 - Sample Collection Documentation, Handling, Tracking, and Custody Procedures	Sample Collection Documentation Handling, Tracking, and Custody SOPs	26
3.3.1 Sample Collection Documentation	Sample Container Identification	26, 27
3.3.2 Sample Handling and Tracking System	Sample Handling Flow Diagram	
3.3.3 Sample Custody	Example Chain-of-Custody Form and Seal	
3.4 - Quality Control (QC) Samples		
3.4.1 Sampling QC Samples	QC Samples Table	28
3.4.2 Analytical QC Samples		
3.5 - Data Management Tasks		
3.5.1 Project Documentation and Records	Project Documents and Records Table	29

QAPP WORKSHEET #2 (CONTINUED)
QAPP IDENTIFYING INFORMATION

Required QAPP Element(s) and Corresponding QAPP Section(s)	Required Information	QAPP Worksheet # or Crosswalk to Related Documents
3.5.2 Data Package Deliverables	Analytical Services Table	30
3.5.3 Data Reporting Formats		23 (specified by analytical method), Data Management Plan
3.5.4 Data Handling and Management	Data Management SOPs	
3.5.5 Data Tracking and Control		
Assessment/Oversight		
4.1 - Assessments and Response Actions	Assessments and Response Actions	
4.1.1 Planned Assessments	Planned Project Assessments Table	31
	Audit Checklists	
4.1.2 Assessment Findings and Corrective Action (CA) Responses	Assessment Findings and CA Responses Table	32
4.2 - QA Management Reports	QA Management Reports Table	33
4.3 - Final Project Report		To be determined (TBD)
Data Review		
5.1 - Overview	Not applicable (NA)	NA
5.2 - Data Review Steps		
5.2.1 Step I: Verification	Verification (Step I) Process Table	34
5.2.2 Step II: Validation		
5.2.2.1 Step IIa Validation Activities	Validation (Steps IIa and IIb) Process Table	35
5.2.2.2 Step IIb Validation Activities	Validation (Steps IIa and IIb) Summary Table	36

QAPP WORKSHEET #2 (CONTINUED)
QAPP IDENTIFYING INFORMATION

Required QAPP Element(s) and Corresponding QAPP Section(s)	Required Information	QAPP Worksheet # or Crosswalk to Related Documents
5.2.3 Step III: Usability Assessment		
5.2.3.1 Data Limitations and Actions from Usability Assessment	Usability Assessment	37
5.2.3.2 Activities		
5.3 - Streamlining Data Review	NA	NA
5.3.1 Data Review Steps to be Streamlined		
5.3.2 Criteria for Streamlining Data Review		
5.3.3 Amounts and Types of Data Appropriate for Streamlining		

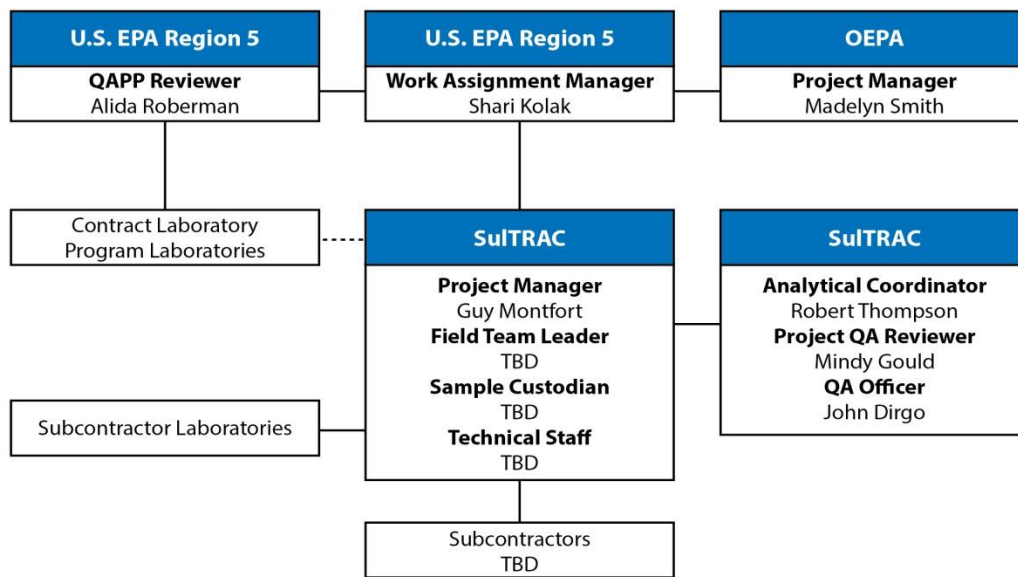
**QAPP WORKSHEET #3
DISTRIBUTION LIST**

QAPP Recipient	Title	Organization	Telephone Number	E-mail Address
Shari Kolak	Work Assignment Manager (WAM)	EPA Region 5	(312) 886-6151	shari.kolak@epa.gov
Alida Roberman	QAPP Reviewer	EPA Region 5	(312) 886-7185	alida.roberman@epa.gov
Madelyn Smith	Project Manager	Ohio EPA	(937) 285-6456	madelyn.smith@epa.state.oh.us
Guy Montfort	Project Manager	SulTRAC	(513) 333-3669	guy.montfort@tetrattech.com
TBD	Field Team Leader	SulTRAC	TBD	TBD
TBD	Project Scientist and Sample Custodian	SulTRAC	TBD	TBD
Mindy Gould	Project QA Reviewer	SulTRAC	(312) 201-7460	mindy.gould@tetrattech.com
John Dirgo	QA Officer	SulTRAC	(312) 201-7765	john.dirgo@tetrattech.com
Robert Thompson	Analytical Coordinator	SulTRAC	(312) 443-0550, ext. 35	rthompson@onesullivan.com
David Homer	Ecological Risk Assessor	SulTRAC	(816) 412-1762	david.homer@tetrattech.com
Eric Morton	Human Health Risk Assessor	SulTRAC	(312) 201-7797	eric.morton@tetrattech.com
Daniel Pittman	Laboratory Manager	Test America	(330) 966-9279	daniel.pittman@testamericainc.com
Josh McKinney	Laboratory Project Manager	Test America	(937) 499-1224	josh.mckinney@testamericainc.com
Subcontractors	Drillers/Geoprobe/ Surveyors/High Resolution Site Characterization Groundwater Profiling, and On-Site Laboratory	TBD	TBD	TBD
Off-site Laboratories	Off-site Laboratory Services, vapor intrusion and soil remediation parameters	TBD	TBD	TBD

QAPP WORKSHEET #4
PROJECT PERSONNEL SIGN-OFF SHEET

Project Personnel	Organization	Title	Telephone No.	Signature	Date QAPP Read
Guy Montfort	SulTRAC	Project Manager	(513) 333-3669		
Robert Thompson	SulTRAC	Analytical Coordinator	(312) 443-0550, ext. 35		
Mindy Gould	SulTRAC	Project QA Reviewer	(312) 201-7460		
John Dirgo	SulTRAC	QA Officer	(312) 201-7765		
TBD	SulTRAC	Project Scientist and Sample Custodian	TBD	TBD	TBD
TBD	SulTRAC	Field Team Leader	TBD	TBD	TBD
Daniel Pittman	Test America	Laboratory Manager	(330) 966-9279		
Drilling Subcontractor	TBD	TBD	TBD	TBD	TBD
Geoprobe Subcontractor	TBD	TBD	TBD	TBD	TBD
Surveyor Subcontractor	TBD	TBD	TBD	TBD	TBD
High Resolution Site Characterization Groundwater Profiling and On-Site Laboratory Subcontractor	TBD	TBD	TBD	TBD	TBD
Off-site Laboratory, vapor intrusion and soil remediation parameters	TBD	TBD	TBD	TBD	TBD

QAPP WORKSHEET #5 PROJECT ORGANIZATION CHART



Notes

EPA: Environmental Protection Agency
 FS: Feasibility study
 OEPA: Ohio Environmental Protection Agency
 QA: Quality assurance
 QAPP: Quality assurance project plan
 RI: Remedial investigation
 TBD: To be determined

PROJECT TEAM ORGANIZATIONAL CHART
 RI/FS EAST TROY
 CONTAMINATED AQUIFER SITE



QAPP WORKSHEET #6
COMMUNICATION PATHWAYS

Communication Drivers	Responsible Entity	Name	Telephone No.	Procedure (Timing, Pathways, etc.)
Point of contact with EPA WAM	Project Manager	Guy Montfort	(513) 333-3669	Guy Montfort will forward all materials and information about the project to Shari Kolak.
Manage all project phases	Project Manager	Guy Montfort	(513) 333-3669	Communicate information to project team (including subcontractors) on a timely basis. Notify EPA WAM by telephone or e-mail of any significant issues. Direct field team and facilitate communication with analytical coordinator. Deliver all laboratory data packages to project QA reviewer for final review of validation.
Daily field progress report	Field Team Leader	TBD		Conduct specific field investigation tasks, direct field activities of subcontractors, and provide daily communication with project manager and sample custodian.
Manage Field Sample Organization and Delivery to CLP	Sample Custodian	TBD		Ensure field staff is collecting samples in proper containers, observing holding times, and properly packaging and preparing samples for shipment. Coordinate daily with analytical coordinator concerning sample quantities and delivery locations and dates. Communicate daily with field staff and project manager regarding any issues and developments.
Point of contact with EPA Region 5 Regional Sample Control Coordinator (RSCC)	Analytical Coordinator	Robert Thompson	(312) 443-0550, ext. 35	Contact the RSCC or subcontractor laboratory before each sampling event to schedule laboratory services. Notify sample custodian and project manager of any laboratory issues or developments. Track all laboratory data deliveries. Notify project manager and forward data to him.
Release of Analytical Data	SulTRAC Project QA Reviewer	Mindy Gould	(312) 201-7460	No analytical data can be released until validation is completed and the QA reviewer has reviewed and approved the release.
Report of laboratory data quality issues	Laboratory QA Officer	TBD	TBD	All QA/QC issues with project field samples will be reported by the laboratory QA officer to the RSCC (for CLP) or to the SulTRAC analytical coordinator (for subcontractor laboratories).

Notes:

CLP	Contract Laboratory Procedure
CRL	Central Regional Laboratory
QA	Quality assurance
QC	Quality control
RSCC	Regional Sample Control Coordinator
TBD	To be determined
WAM	Work assignment manager

QAPP WORKSHEET #7
PERSONNEL RESPONSIBILITIES AND QUALIFICATIONS TABLE

Name	Title	Organization/ Affiliation	Responsibilities	Education and Experience Qualifications
Guy Montfort*	Project Manager	SulTRAC	Manages project; coordinates between lead agency and subcontractor; coordinates laboratory data deliverables from analytical coordinator to project QA reviewer; manages field staff	B.S. Geophysical Engineering, 24 years of experience
TBD*	Field Team Leader	SulTRAC	Supervises field sampling and coordinates all field activities; daily reporting to project manager while conducting field activities	TBD
TBD*	Project Scientist Sample Custodian	SulTRAC	Prepares QAPP; implements field plan; verifies sample processing, packaging, and shipping	TBD
Mindy Gould	Project QA Reviewer	SulTRAC	QA/QC oversight	M.S. Environmental Engineering, 30 years of experience
John Dirgo	QA/QC Officer	SulTRAC	QA/QC oversight	B.S. Biology; M.S. and Sc.D. Environmental Health Sciences; 34 years of experience
Robert Thompson*	Analytical Coordinator	SulTRAC	Coordinates sample scheduling; verifies sample chain of custody; reviews computer-aided data review and evaluation (CADRE) results and data from subcontracted laboratories; notifies sample custodian and project manager of any issues or developments	B.A. Chemistry, 9 years of experience
TBD*	Technical Staff	SulTRAC	Implements field plan	TBD
TBD	Surveyors	TBD Subcontractor	Provides survey of high resolution site characterization groundwater profiling and new monitoring well location at the site.	TBD
TBD	High Resolution Site Characterization Groundwater Profiling and On-Site Laboratory Director	TBD Subcontractor	Provides high resolution site characterization multi-level groundwater profiling and on-site laboratory analyses	TBD
TBD	Drillers	TBD Subcontractor	Installs monitoring wells	TBD
TBD	Geoprobe driller	TBD Subcontractor	Geoprobe drilling for subsurface and sub-slab soil samples	TBD
TBD	Off-site Laboratory Director	Subcontracted Laboratory	Provides analytical services for the vapor intrusion monitoring samples, including indoor air, sub-slab soil vapor, and ambient air	TBD
TBD	Off-site (local) Laboratory Director	Subcontracted Laboratory	Provides analytical services for the soil remediation parameters.	TBD
Daniel Pittman	Off-site Laboratory Director	Test America, Inc.	Provides analytical services for the groundwater remediation parameters.	B.S. Administrative Management, 2 months of experience

Note:
Project team members identified with an asterisk (*).

QAPP WORKSHEET #8
SPECIAL PERSONNEL TRAINING REQUIREMENTS TABLE

Project Function	Specialized Training – Title or Description of Course	Training Provider	Training Date	Personnel/Groups Receiving Training	Personnel Titles/ Organizational Affiliation	Location of Training Records/Certificates
Field Staff	40-hour and 8-hour refresher - OSHA HAZWOPER training	Various	Various	SulTRAC	SulTRAC	Corporate human resources office
Subcontractors	40-hour OSHA HAZWOPER training	TBD	TBD	High resolution site characterization groundwater profiling subcontractor, Geoprobe operators, drillers, and surveyors	TBD	As noted in subcontract agreements – corporate human resources office

Notes:

HAZWOPER Hazardous Waste Operations and Emergency Response Standard
 OSHA Occupational Safety and Health Administration
 TBD To be determined

QAPP WORKSHEET #9
PROJECT SCOPING SESSION PARTICIPANTS SHEET

Project Name	Expanded Phase II RI/FS for East Troy Contaminated Aquifer Site		Site Name	East Troy Contaminated Aquifer Site	
Projected Date(s) of Sampling	October 2013 through December 2013		Site Location	City of Troy, Miami County, Ohio	
Project Manager	Guy Montfort				
Date of Session	June 6, 2013				
Scoping Session Purpose: Define scope of project					
Name	Title	Affiliation	Phone #	E-Mail Address	Project Role
Shari Kolak	WAM	EPA Region 5	(312) 886-6151	Shari.kolak@epa.gov	WAM
Madelyn Smith	Project Manager	Ohio EPA	(937) 285-6456	madelyn.smith@epa.state.oh.us	Project Manager
Guy Montfort	Project Manager	SulTRAC	(513) 333-3669	guy.montfort@tetrattech.com	Project Manager
Mindy Gould	Program Manager	SulTRAC	(312) 201-7460	mindy.gould@tetrattech.com	Program Manager

Attendees: **Ohio EPA:** Madelyn Smith, Randy Watterworth, Brian Nickel, Mark Allen (via conference call); **EPA:** Shari Kolak, Keith Fusinski, and Ruth Muhtsun (note taker); and, **SulTRAC:** Guy Montfort, Mindy Gould, Ray Mastrolonardo, Eric Morton, and Kris Schnoes.

Comments/Decisions: During this meeting, SulTRAC discussed the results of the initial Phase II remedial investigation (RI) in detail. After a lengthy discussion, EPA and Ohio EPA agreed that additional sampling at the potential source areas is needed to define the extent of contamination so that a risk assessment can be performed and remedial alternatives evaluated.

The group discussed how to characterize the potential source areas that may be located under buildings. SulTRAC pointed out that it may be difficult to sample underneath buildings. For example, at the church at 10 East Main Street, access may be difficult or impossible because utility and electrical lines are present, unless samples are collected by drilling through the basement floor, which may not be possible if access is denied or space is limited. SulTRAC also explained that secondary source areas such as residual pockets of groundwater contamination, rather than contaminated soil, may be acting as the ongoing source of contamination to groundwater.

The group also discussed the Draft RI Scoping Memo. Ohio EPA asked if there is a plan for additional vapor intrusion (VI) sampling and whether homes with existing mitigation systems will be periodically sampled. EPA will determine if the new EPA VI guidance will be implemented at the East Troy site.

Ohio EPA inquired if other pathways, in addition to the groundwater VI pathway, would be considered in the human health risk assessment. EPA and Ohio EPA requested that the drinking water pathway be evaluated since it appears some homeowners may have retained their private wells for irrigation. SulTRAC mentioned that some owners may be using their private wells to water their vegetable gardens. EPA asked that this pathway be evaluated in the risk assessment.

QAPP WORKSHEET #9 (CONTINUED)
PROJECT SCOPING SESSION PARTICIPANTS SHEET

Project Name	Expanded Phase II RI/FS for East Troy Contaminated Aquifer Site		Site Name	East Troy Contaminated Aquifer Site	
Projected Date(s) of Sampling	October 2013 through December 2013		Site Location	City of Troy, Miami County, Ohio	
Project Manager	Guy Montfort				
Date of Session	July 17, 2013				
Scoping Session Purpose:	Define scope of project				
Name,	Title	Affiliation	Phone #	E-Mail Address	Project Role
Shari Kolak	WAM	EPA Region 5	(312) 886-6151	Shari.kolak@epa.gov	WAM
Madelyn Smith	Project Manager	Ohio EPA	(937) 285-6456	madelyn.smith@epa.state.oh.us	Project Manager
Guy Montfort	Project Manager	SulTRAC	(513) 333-3669	guy.montfort@tetrattech.com	Project Manager

Attendees: **Ohio EPA:** Madelyn Smith, Randy Watterworth, Mark Allen, Allison Reed (via conference call); **EPA:** Shari Kolak, Keith Fusinski, Ajit Vaidya, Andrew Podowski, Ruth Muhtsun (note taker); and **SulTRAC:** Guy Montfort, Ray Mastrodonardo, and Kris Schnoes.

Comments/Decisions: The group discussed the site visit conducted by Ohio EPA, EPA, and SulTRAC on July 2 and July 3 to inspect on-site potential source areas including inside basements of buildings to determine if there are potential conduits for contaminant releases and to assess the feasibility of installing direct push Geoprobe borings in buildings. The group discussed each potential source area inspected during the site visit and potential additional investigation activities.

10 East Main Street: Ohio EPA inquired if exterior soil gas sampling is feasible by accessing the site through the alley next to the old church addition. EPA inquired about sampling in the court yard area facing Main Street. SulTRAC indicated the courtyard area is about 3 feet below the ground surface and, in addition to the property owner's likely objection, access would be difficult.

102 East Main Street: The site visit suggested that this building is not likely a primary source area.

432 East Main Street: The group agreed that additional soil borings outside and soil gas samples inside the building should be considered for the expanded Phase II RI.

QAPP WORKSHEET #9 (CONTINUED)
PROJECT SCOPING SESSION PARTICIPANTS SHEET

Spinnaker: Ohio EPA confirmed that the contaminant concentrations listed in the Supplemental Soil and Groundwater Delineation Report prepared by Kimberly-Clark (K-C) were samples collected after soil excavation and remediation activities were complete (Shaw 2006). SulTRAC indicated that soil was excavated to meet the direct contact standards and that K-C performed modeling to demonstrate that the remaining residual soil contamination was not leaching to groundwater in concentrations that would pose a significant risk to the well field. SulTRAC indicated that K-C believes the contamination along the building was a result of cleaning equipment in buckets of TCE at the loading dock. EPA suggested additional investigation in the hot spot area near monitoring well KMW-10. SulTRAC indicated that no specific sources have been identified in this area to focus investigations. Ohio EPA speculated that buckets of used solvents could have been spilled in this area as possibly a dust suppressant or weed control. Ohio EPA suggested that a potential source may exist under the crawl space near the northwest corner of the building – possibly TCE-soaked soils under the building – and that additional sampling should be done to characterize the extent of contamination in this area.

Hobart: Ohio EPA suggested additional sampling at Hobart to fully characterize all potential source areas on the property, including collecting soil samples outside the building at the location of the former degreaser to determine if soils are impacted.

Project Name	Expanded Phase II RI/FS for East Troy Contaminated Aquifer Site		Site Name	East Troy Contaminated Aquifer Site	
Projected Date(s) of Sampling	October 2013 through December 2013		Site Location	City of Troy, Miami County, Ohio	
Project Manager	Guy Montfort				
Date of Session	August 5, 2013				
Scoping Session Purpose:	Define scope of project				
Name,	Title	Affiliation	Phone #	E-Mail Address	Project Role
Shari Kolak	WAM	EPA Region 5	(312) 886-6151	Shari.kolak@epa.gov	WAM
Madelyn Smith	Project Manager	Ohio EPA	(937) 285-6456	madelyn.smith@epa.state.oh.us	Project Manager
Guy Montfort	Project Manager	SulTRAC	(513) 333-3669	guy.montfort@tetrattech.com	Project Manager

Attendees: **Ohio EPA:** Madelyn Smith, Mark Allen, Allison Reed (via conference call); **EPA:** Shari Kolak, Dave Wilson, Keith Fusinski, Ed Karecki, Andrew Podowski, Ruth Muhtsun (note taker); **SulTRAC:** Ray Mastrodonardo and Kris Schnoes.

QAPP WORKSHEET #9 (CONTINUED)
PROJECT SCOPING SESSION PARTICIPANTS SHEET

Comments/Decisions: The group discussed the scope of the expanded Phase II investigation and agreed that the following activities would be conducted during the investigation:

- Investigation of potential secondary source areas at Crawford and Clay
- Collection of water levels at existing monitoring wells
- Surface soil samples should be collected at Hobart and Spinnaker unless restrictions preventing future residential use will be implemented.

The team discussed the potential implementation of high resolution site characterization techniques during the expanded Phase II RI.

Project Name	Expanded Phase II RI/FS for East Troy Contaminated Aquifer Site		Site Name	East Troy Contaminated Aquifer Site	
Projected Date(s) of Sampling	October 2013 through December 2013		Site Location	City of Troy, Miami County, Ohio	
Project Manager	Guy Montfort				
Date of Session	August 29, 2013				
Scoping Session Purpose:	Define scope of project				
Name,	Title	Affiliation	Phone #	E-Mail Address	Project Role
Shari Kolak	WAM	EPA Region 5	(312) 886-6151	Shari.kolak@epa.gov	WAM
Madelyn Smith	Project Manager	Ohio EPA	(937) 285-6456	madelyn.smith@epa.state.oh.us	Project Manager
Guy Montfort	Project Manager	SulTRAC	(513) 333-3669	guy.montfort@tetrattech.com	Project Manager

Attendees: **Ohio EPA** Madelyn Smith, Mark Allen, Allison Reed; **EPA:** Shari Kolak, Keith Fusinski, Andrew Podowski, Ruth Muhtsun; and **SulTRAC:** Guy Montfort and Ray Mastrodonardo.

Comments/Decisions: The group discussed the expanded Phase II RI Sampling and Analysis Plan (SAP). SulTRAC indicated that the SAP would be submitted in early October. The SAP will include high resolution site characterization (HRSC) multilevel groundwater profiling. HRSC groundwater profiling locations will be contingent upon the membrane interface probe (MIP) results. An on-site laboratory will analyze samples collected during HRSC groundwater profiling. The SAP will also include surface and subsurface soil sampling contingent on the MIP and groundwater profiling data, and additional vapor intrusion sampling.

QAPP WORKSHEET #9 (CONTINUED)
PROJECT SCOPING SESSION PARTICIPANTS SHEET

Project Name	Expanded Phase II RI/FS for East Troy Contaminated Aquifer Site		Site Name	East Troy Contaminated Aquifer Site	
Projected Date(s) of Sampling	October 2013 through December 2013		Site Location	City of Troy, Miami County, Ohio	
Project Manager	Guy Montfort				
Date of Session	September 9, 2013				
Scoping Session Purpose:	Define scope of project				
Name,	Title	Affiliation	Phone #	E-Mail Address	Project Role
Shari Kolak	WAM	EPA Region 5	(312) 886-6151	Shari.kolak@epa.gov	WAM
Madelyn Smith	Project Manager	Ohio EPA	(937) 285-6456	madelyn.smith@epa.state.oh.us	Project Manager
Guy Montfort	Project Manager	SulTRAC	(513) 333-3669	guy.montfort@tetrattech.com	Project Manager

Attendees: **Ohio EPA** Madelyn Smith, Mark Allen, Allison Reed; **EPA:** Shari Kolak, Keith Fusinski, Andrew Podowski, Ruth Muhtsun; and **SulTRAC:** Guy Montfort and Ray Mastrodonardo.

Comments/Decisions: SulTRAC clarified that additional soil or groundwater samples will be collected to fully characterize the potential source areas regardless of the membrane interface probe results. Additional field sampling activities will be presented in the SAP. SulTRAC also clarified the definition of primary and secondary potential source areas.

QAPP WORKSHEET #10

PROBLEM DEFINITION

The problem to be addressed by the project: Since 1988, volatile organic compounds (VOC) have been detected in the City of Troy's East Wellfield, a municipal drinking water wellfield located approximately 0.25 mile and across the Great Miami River from an identified VOC plume area. Cis-1,2-dichloroethene (cis-1,2-DCE) is the compound detected most frequently in the East Wellfield. The chlorinated VOCs tetrachloroethene (PCE), trichloroethene (TCE) and cis-1,2-DCE have been detected in samples from production wells in the West Wellfield. However, the sources of contamination in each wellfield are currently believed to differ. This Remedial Investigation/Feasibility Study (RI/FS) addresses only the area of contamination affecting the East Wellfield.

Between August 2010 and June 2012, SulTRAC conducted the Phase I RI including drilling and installation of groundwater monitoring wells; soil borings with soil and groundwater sampling; a vertical aquifer sampling (VAS) program; a camera investigation of the sanitary sewer system; groundwater sampling; sediment and surface water sampling in the Great Miami River; and a vapor intrusion monitoring program.

SulTRAC conducted initial Phase II RI activities between August 2012 and April 2013. Phase II included resampling of some Phase I vapor intrusion sampling locations, collecting groundwater elevation measurements, additional VAS and monitoring well installation, a second comprehensive groundwater sampling event, collecting soil samples and shallow groundwater screening samples, and additional vapor intrusion (VI) sampling. In addition, a site visit focused on identifying potential sources was conducted by SulTRAC, the U.S. Environmental Protection Agency (EPA), and Ohio EPA in July 2013.

RI data collected to date has identified the following two groundwater plume areas:

1. Residential Area Plume
2. Water Street Plume

Concentrations of PCE and TCE exceeding maximum contaminant levels (MCL) and vapor intrusion screening levels (VISL) are present in both plume areas. Cis-1,2-DCE has been detected most frequently in the Water Street Plume at concentrations below MCLs and VISLs. Groundwater contaminant concentrations in these plume areas have not decreased over time, indicating that continuing sources may exist at the primary source areas. Alternatively, residual VOCs may be sorbed to fine-grain subsurface material or in the zone of groundwater fluctuation, resulting in an ongoing secondary source of contamination. The primary purpose of this expanded Phase II RI is to determine if additional source areas exist and further delineate the primary source areas identified.

QAPP WORKSHEET #10 (CONTINUED)

PROBLEM DEFINITION

Residential Area Plume Source Areas

Three potential source areas have been identified within the Residential Plume Area: (1) a former dry cleaner at 10 East Main Street, (2) a former dry cleaner at 432 East Main Street, and (3) a potential secondary source in the vicinity of Clay and Franklin Streets. The Residential Area Plume originates in the vicinity of the former dry cleaner located at 10 East Main Street and stretches southeast for nearly ¾-mile to Floral Avenue. The building that housed the former dry cleaner and the adjacent structure to the east at 12 East Main Street were reportedly demolished to make room for the addition to the First Presbyterian Church constructed in the 1990s. The original structure at 10 East Main reportedly had no basement. The basement floor of the present structure sits approximately 6 to 7 feet below sidewalk level, indicating that at least the uppermost 7 feet of soil was excavated and removed during construction of the church addition. During the recent site reconnaissance on July 2 and 3, 2013, no additional source areas were identified. However, it is unknown if source material remains beneath the church building addition. An additional former dry cleaner has been identified within the plume area at 432 East Main Street. One groundwater sample collected downgradient of this location contained moderate concentrations of PCE. Finally, an area of consistently elevated PCE and TCE groundwater concentrations is located in the vicinity of Clay and Franklin Streets, indicating that a secondary potential source area may exist. No primary sources have been identified in this area.

In addition, the leading edge of the Residential Area Plume is currently defined by temporary monitoring points. A permanent well is needed for effective long-term monitoring of the plume's leading edge.

Water Street Plume Source Areas

The Phase I and initial Phase II RI identified existing primary potential source areas of contaminated soil within the Water Street Plume area at Hobart Cabinet Company (Hobart) located at 301 East Water Street and Spinnaker Coating, Inc. (Spinnaker), located at 518 East Water Street. At Hobart, significant concentrations of chlorinated solvents and associated daughter products (PCE, TCE, 1,1,2-trichloroethane [1,1,2-TCA], and DCE) and other VOCs (benzene, ethylbenzene, and xylene) have been detected in soil in the loading dock area. Soil contamination was detected in both shallow (1 to 4 feet bgs) and deep (10 to 12 feet bgs) soil, indicating that surface disposal or spillage likely occurred; however, no specific sources have been identified. Furthermore, the on-site source investigation identified the location of a former vapor degreaser inside the central portion of the building, which may be an additional potential source of on-site soil and groundwater contamination.

At Spinnaker, RI data, 2007 Geoprobe groundwater data from Ohio EPA (Ohio EPA 2007), and data from investigations conducted by the former site owner, Kimberly-Clark Corporation (Shaw 2006), have delineated wide-spread shallow and deep (1 to 12 feet bgs) soil contamination throughout the west parking lot area and outside the northwestern corner of the Spinnaker building, as well as groundwater contamination throughout the site. Contaminants detected in soil or groundwater include chlorinated solvents and associated daughter products (PCE, TCE, DCE, 1,1,1-trichloroethane [1,1,1-TCA], dichloroethane [DCA], and vinyl chloride) and other VOCs (benzene, toluene, ethylbenzene, and xylene). Previous potential sources identified in the west parking lot area include a former material and waste storage area, including a former bulk storage area, former hazardous waste area, and a former 300-gallon gasoline underground storage tank. One additional potential source area is a former dry cleaner located in the southeastern portion of the west parking lot. However, shallow soil contamination exists throughout the west parking lot outside of these former potential source areas, including in the vicinity of Spinnaker monitoring well KMW-10, which is located at the western site fence, at a depth of 2 to 4 feet bgs. Groundwater samples from Spinnaker monitoring well KMW-10, located at the western (upgradient) site boundary have historically contained the highest

QAPP WORKSHEET #10 (CONTINUED)

PROBLEM DEFINITION

reported concentrations of VOCs at the site, with cis-1,2-DCE concentrations ranging as high as >100 µg/L. However, no known historic manufacturing operations or other obvious sources of this contamination have yet been identified in this area and none were observed during the July 2013 site reconnaissance.

An additional area of soil and groundwater contamination has been identified outside the northwestern corner of the Spinnaker building near a former nonhazardous waste storage area, which was used to store empty drums and nonhazardous adhesive materials. Shallow soil and groundwater contamination is also present between the northwest corner of the building and the levee. Elevated concentrations of TCE, 1,1,1-TCA, and cis-1,2-DCE in soil (5 to 9 feet bgs) were also detected near the northwest corner of the main building during the initial Phase II RI. Elevated concentrations of PCE, TCE, 1,1,1-TCA, cis-1,2-DCE, DCA, and vinyl chloride have been detected in groundwater near the northwest corner of the main building. However, no known historic manufacturing operations or other obvious sources of this contamination have yet been identified between the building and the levee and none were observed during the July 2013 site reconnaissance.

Another potential area of concern within the Water Street Plume is the area southeast of Spinnaker adjacent to the Great Miami River, which is directly across the river from the City of Troy production well where cis-1,2-DCE has been detected. It is unclear if and where groundwater contamination may be migrating under the river toward the production well.

Other Areas of Investigation

In addition to the groundwater and soil contamination, elevated levels of PCE, TCE, and cis-1,2-DCE were detected in soil gas and indoor air of structures within the groundwater plume areas during the Phase I and initial Phase II RI. However, indoor air or soil gas samples were not collected at suspected source areas located at 10 East Main Street or 432 East Main Street because of access restrictions.

Four surface water and sediment samples were collected from the Great Miami River during Phase I; however, no samples were collected south of the Spinnaker property. Since then, the Water Street Plume has been found to extend as far south as Ellis Street, about 900 feet south of the Spinnaker property.

Soil and groundwater samples will be collected to facilitate evaluation of remedial alternatives in the feasibility study (FS). Soil parameters will evaluate the potential effectiveness of in situ remediation technologies in saturated and unsaturated zones. Groundwater parameters will evaluate the effectiveness of natural attenuation and other in-situ remediation technologies. VOC groundwater analyses will evaluate the relationship between remediation parameters and VOC contaminant concentrations.

SulTRAC will collect three rounds of groundwater elevation measurements during the expanded Phase II investigation. These will include, at least one set of measurements concurrent with a period when the City of Troy is using at least one of each of the production wells in which low levels of VOCs have been detected. These include wells P-14, P-18 and P-17.

SulTRAC will also conduct elevation surveys at the newly installed monitoring wells, as well as, up to 20 Spinnaker monitoring wells that have not been previously surveyed by EPA. Finally, SulTRAC will survey residents regarding private well use because of anecdotal evidence of residents using hand-dug wells for irrigation.

The environmental questions being asked: Are existing source areas contributing to contamination at the East Troy Contaminated Aquifer Site? What is the extent of vapor intrusion contamination at the site? What remedial technologies may be effective at this site?

QAPP WORKSHEET #10 (CONTINUED)
PROBLEM DEFINITION

Observations from any site reconnaissance reports: Discussions of previous reconnaissance reports can be found in the previous QAPPs prepared for this project (SulTRAC 2010 and 2011). In July 2013, SulTRAC, EPA, and Ohio EPA conducted a source area reconnaissance visit, when the following potential source areas were identified or confirmed: 10 East Main, 432 East Main, potential secondary source at Clay and Franklin, Hobart, and Spinnaker. These potential source areas will be investigated further during this expanded Phase II RI.

A synopsis of secondary data or information from site reports: See Worksheet #13

The possible classes of contaminants and the affected matrices: Data collected by EPA, Ohio EPA, the City of Troy, and private entities indicate that chlorinated VOCs are the primary contaminants of concern. Other VOCs such as benzene, toluene, ethylbenzene, and xylene are also of concern at the Hobart and Spinnaker sites. Affected matrices defined to date include groundwater, subsurface soil, sub-slab soil vapor, and indoor air.

Project decision conditions (“If..., then...” statements): If expanded Phase II source characterization activities indicate that additional sources of contamination are present at the East Troy site, then these sources will be addressed in the FS. If indoor air monitoring activities indicate an unacceptable risk to human health and/or the environment, then the vapor intrusion pathway will be addressed in the FS or an interim remedial action may be implemented, if necessary. If remediation parameter data indicate that remedial technologies may be effective at the site, then these technologies will be evaluated in the feasibility study.

QAPP WORKSHEET #11
PROJECT QUALITY OBJECTIVES/SYSTEMATIC PLANNING PROCESS STATEMENTS

Who will use the data: EPA Region 5, Ohio EPA, and SulTRAC will use the data.

What will the data be used for? During the expanded Phase II field investigation, the data will be used to characterize potential contamination sources, as well as determine the nature of the contamination at the East Troy site. Groundwater HRSC direct-push multilevel profiling data will be used to determine if and where additional profiling data or new monitoring wells may be needed. Soil and groundwater remediation parameter data will be used to evaluate the effectiveness of remedial technologies in the FS. Data from the Phase I and Phase II field investigations will be referenced by those conducting a risk assessment for the entire East Troy site and evaluating remedial alternatives in the FS.

What type of data is needed (target analytes, analytical groups, field screening, on-site analytical or off-site laboratory techniques, sampling techniques)? SulTRAC will conduct a MIP investigation prior to the expanded Phase II RI activities included in this SAP. The scope and procedures of the MIP investigation are detailed in the MIP Investigation Sampling Plan (SulTRAC 2013). MIP is an HRSC technique that will be used to obtain a higher density of screening level data at the suspected source areas. The results of the MIP investigation will likely impact the number and locations of soil and groundwater samples collected as part of this expanded Phase II RI. Therefore, the sample numbers and locations presented in this SAP are estimates and actual numbers and locations may vary.

Source Characterization - Soil

A total of 33 surface soil samples will be collected at 29 locations at the Hobart and Spinnaker and 432 East Main potential source areas. A total of 45 subsurface soil samples will be collected from 20 locations at the Hobart and Spinnaker and 432 East Main potential source areas. Subsurface soil samples will be collected at depth intervals where visual evidence, odors, or photoionization detector (PID) screening indicates soil contamination. Surface and subsurface soil samples will be analyzed for VOCs through the EPA CLP. The procedures for collection and analysis of soil samples are presented in SulTRAC's Phase I RI QAPP (SulTRAC 2010). Additional subsurface soil samples may be collected at the 10 East Main Street Residential Plume potential source area if MIP investigation results indicate that soil contamination is present in this area.

Source Characterization - Groundwater

SulTRAC will conduct HRSC direct-push multilevel groundwater profiling at 27 initial locations and possibly at eight contingency locations. Groundwater samples are initially planned at 5 foot intervals to a depth of 80 feet bgs. Therefore, a total of 574 groundwater samples are estimated at the potential source areas. Groundwater samples will be analyzed on-site for target VOCs using a mobile laboratory for fast turnaround. Target VOCs for the Residential Area and Water Street Plumes include cis-1,2-DCE, PCE, TCE, and vinyl chloride. Target VOCs for the Water Street Plume also include benzene, toluene, ethylbenzene, xylene, 1,1,1- TCA, 1,1,2-TCA, and 1,1-DCA. Water Street Plume groundwater profiling samples will include TCA, DCA, and BTEX only at select locations which will be identified based on previous soil and groundwater data. Mobile laboratory results may be used to guide or modify subsequent HRSC sampling locations. HRSC groundwater profiling will also provide detailed data relative to the distribution of hydraulic conductivity and hydraulic head, pH, specific conductance, dissolved oxygen, and oxidation reduction potential (ORP) in order to correlate VOC concentrations with these other parameters.

QAPP WORKSHEET #11 (CONTINUED)
PROJECT QUALITY OBJECTIVES/SYSTEMATIC PLANNING PROCESS STATEMENTS

In addition, seven initial and one contingent groundwater profiling locations are planned southeast of Spinnaker along the river, across from the Troy production well where cis-1,2-DCE has been detected, to determine if and where groundwater contamination may be migrating under the river.

Other Areas of Investigation

SulTRAC will collect seven sub-slab, seven indoor air samples, and three ambient air samples. Air samples will be analyzed for VOCs by an off-site laboratory. The procedures for collection and analysis of vapor intrusion samples are presented in SulTRAC's vapor intrusion monitoring program QAPP for the ETCA site (SulTRAC 2011).

SulTRAC will collect four sediment and two surface water samples from the Great Miami River. Surface water and sediment samples will be analyzed for VOCs through the EPA CLP. The procedures for collection and analysis of sediment and surface water samples are presented in SulTRAC's Phase I RI QAPP (SulTRAC 2010).

SulTRAC will collect two groundwater samples from a new monitoring well installed at the leading edge of the Residential Area Plume. The groundwater samples will be analyzed for VOCs through the EPA CLP. The procedures for collection and analysis of groundwater samples are presented in SulTRAC's Phase I RI QAPP (SulTRAC 2010).

SulTRAC will collect three rounds of groundwater elevation measurements during the expanded Phase II investigation. These will include, at least one set of measurements concurrent with a period when the City of Troy is using at least one of each of the production wells in which low levels of VOCs have been detected. These include wells P-14, P-18 and P-17.

SulTRAC will also conduct elevation surveys at the newly installed monitoring wells, as well as, up to 20 Spinnaker monitoring wells that have not been previously surveyed by EPA. Finally, SulTRAC will survey residents regarding private well use because of anecdotal evidence of residents using hand-dug wells for irrigation.

Remediation Parameters

Soil and groundwater samples will be collected to facilitate evaluation of remedial alternatives in the FS. SulTRAC will collect seven soil samples from three locations for analysis of total organic carbon, grain size/particle size distribution, hydraulic conductivity, soil permeability, bulk soil density and porosity. SulTRAC will collect 10 groundwater samples from eight locations for analysis of anions (chloride, sulfate, nitrate, fluoride, and bromide), ferrous iron, dissolved gases (methane, ethane, and ethene), total organic carbon, alkalinity, and total dissolved solids. SulTRAC will collect 10 groundwater samples from eight locations for VOC analysis by a CLP laboratory. In addition, the following groundwater field parameters will be collected from each well where remediation parameter sampling will be conducted: temperature, pH, specific conductance, dissolved oxygen, and ORP. The soil remediation parameter samples will be analyzed by an off-site laboratory. The groundwater remediation parameter samples will be analyzed by TestAmerica, Inc., in Canton, Ohio.

How "good" do the data need to be in order to support the environmental decision? Ultimately, the data from SulTRAC's samples of soil, water, sediment, indoor air, and sub-slab vapor need to allow full assessment of the nature and extent of contamination in groundwater, subsurface soil, and other environmental media. The data also need to support a risk assessment and evaluation of remedial alternatives.

QAPP WORKSHEET #11 (CONTINUED)
PROJECT QUALITY OBJECTIVES/SYSTEMATIC PLANNING PROCESS STATEMENTS

<p>How much data are needed (number of samples for each analytical group, matrix, and concentration)?</p> <p>See above for sample numbers, analytical groups, matrix, and concentrations.</p> <p>QC samples will be collected and analyzed, including duplicates, matrix spikes (MS), matrix spike duplicates (MSD), and trip blanks.</p>
<p>Where, when, and how should the data be collected/generated? See above answers in Worksheet #10 and #11.</p>
<p>Who will collect and generate the data? SulTRAC will collect all the samples discussed herein. VOCs in surface and subsurface soil, sediment, surface water, and groundwater will be analyzed by a laboratory from the EPA CLP.</p> <p>The vapor intrusion and soil remediation parameter samples will be analyzed by an off-site laboratory. The groundwater remediation parameter samples will be analyzed by TestAmerica, Inc. in Canton, Ohio.</p> <p>The HRSC groundwater profiling samples will be analyzed by an on-site laboratory.</p>
<p>How will the data be reported? Data will be reported by the CLP laboratory using standard data reporting techniques. Data will be reported in electronic and hard-copy formats. The vapor intrusion, remediation parameter, and HRSC groundwater profiling data will be reported by the subcontracted laboratories using standard data reporting techniques.</p>
<p>How will the data be archived? Electronic and hard copies of CLP analytical data will be archived by the individual laboratory. Electronic and hard copies of subcontracted laboratory data will be archived by the SulTRAC analytical coordinator. Field data (notebooks, sampling sheets) will be maintained at SulTRAC's Chicago office. SulTRAC will also provide 10-year data storage.</p>

QAPP WORKSHEET #12
MEASUREMENT PERFORMANCE CRITERIA TABLE

Matrix	Water				
Analytical Group	VOCs ³				
Concentration Level	Low concentration				
Sampling Procedure¹	Analytical Method SOP²	DQIs	Measurement Performance Criteria	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A), or both (S&A)
S-5	A-4	Precision	RPD \leq 50%	Field duplicate	S & A
S-5	A-4	Accuracy/ Bias-Contamination	VOC < QL	Trip blank	S & A
S-5	A-4	Accuracy/ Bias-Contamination	VOC < QL	Rinsate blank	S & A
S-5	A-4	Accuracy/Bias	1,1-Dichloroethene: 61-145 %R TCE: 71-120 %R Benzene: 76-127 %R Toluene: 76-125 %R	MS/MSD	S & A
S-5	A-4	Precision	1,1-Dichloroethene: 14% RPD TCE: 14% RPD Benzene: 11% RPD Toluene: 13% RPD	MS/MSD	S & A
S-5	A-4	Accuracy	Vinyl chloride-d ₃ : 65-131 %R Chloroethane-d ₅ : 71-131 %R 1,1-Dichloroethene-d ₂ : 55-104 %R 1,2-Dichloroethane-d ₄ : 78-129 %R Benzene-d ₆ : 77-124 %R Toluene-d ₈ : 77-121 %R 1,1,2,2-Tetrachloroethane-d ₂ : 73-125 %R 1,2-Dichlorobenzene-d ₄ : 80-131 %R	Deuterated monitoring compounds	A
S-5	A-4	Accuracy/ Bias-Contamination	VOC < QL	Method blank	A
S-5	A-4	Completeness	\geq 90%	Data completeness defined as data not qualified as rejected after validation	S & A

QAPP WORKSHEET #12 (CONTINUED)
MEASUREMENT PERFORMANCE CRITERIA TABLE

Matrix	Water				
Analytical Group	RP—Inorganic Anions				
Concentration Level	N/A				
Sampling Procedure¹	Analytical Method SOP²	DQIs	Measurement Performance Criteria	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A), or both (S&A)
S-5	A-6	Precision	≤20% RPD	Laboratory Duplicate	S & A
S-5	A-6	Accuracy	Chloride, fluoride, bromide, nitrate, sulfate, 80-120%R	MS	S & A
S-5	A-6	Accuracy/Bias, Contamination	Chloride, fluoride, bromide, nitrate, sulfate, < RL	Method Blank	A
S-5	A-6	Accuracy	Chloride, fluoride, bromide, nitrate, sulfate, 90-110%R	Laboratory Control Sample	A
S-5	A-6	Completeness	≥90%	Data completeness defined as data not qualified or rejected after validation	S & A

QAPP WORKSHEET #12 (CONTINUED)
MEASUREMENT PERFORMANCE CRITERIA TABLE

Matrix	Water				
Analytical Group	RP—Dissolved gases				
Concentration Level	N/A				
Sampling Procedure¹	Analytical Method SOP²	DQIs	Measurement Performance Criteria⁴	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A), or both (S&A)
S-5	A-7	Precision	≤20% RPD	Laboratory Duplicate	S & A
S-5	A-7	Accuracy	Methane, ethane, ethene, 60-140% R;	MS/MSD	S & A
S-5	A-7	Precision	Methane, ethane, ethene, ≤35% RPD	MS/MSD	S & A
S-5	A-7	Accuracy/Bias, Contamination	Methane, ethane, ethene, <RL	Method Blank	A
S-5	A-7	Accuracy	Methane, ethane, ethene, 60-140% R	Laboratory Control Sample	A
S-5	A-7	Completeness	≥90%	Data completeness defined as data not qualified or rejected after validation	S & A

QAPP WORKSHEET #12 (CONTINUED)
MEASUREMENT PERFORMANCE CRITERIA TABLE

Matrix	Water				
Analytical Group	RP—TOC				
Concentration Level	N/A				
Sampling Procedure¹	Analytical Method SOP²	DQIs	Measurement Performance Criteria	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A), or both (S&A)
S-5	A-8	Precision	≤20% RPD	Laboratory Duplicate	S & A
S-5	A-8	Accuracy	TOC, 72-136%R	MS/MSD	S & A
S-5	A-8	Precision	TOC, ≤20% RPD	MS/MSD	S & A
S-5	A-8	Accuracy/Bias, Contamination	<RL	Method Blank	A
S-5	A-8	Accuracy	TOC, 88-115%R	Laboratory Control Sample	A
S-5	A-8	Completeness	≥90%	Data completeness defined as data not qualified or rejected after validation	S & A

QAPP WORKSHEET #12 (CONTINUED)
MEASUREMENT PERFORMANCE CRITERIA TABLE

Matrix	Water				
Analytical Group	RP—Alkalinity				
Concentration Level	N/A				
Sampling Procedure¹	Analytical Method SOP²	DQIs	Measurement Performance Criteria	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A), or both (S&A)
S-5	A-9	Precision	≤20% RPD	Laboratory Duplicate	S & A
S-5	A-9	Accuracy/Bias, Contamination	Alkalinity < RL	Method Blank	A
S-5	A-9	Accuracy	Alkalinity, 90-127%R	Laboratory Control Sample	A
S-5	A-9	Completeness	≥90%	Data completeness defined as data not qualified or rejected after validation	S & A

QAPP WORKSHEET #12 (CONTINUED)
MEASUREMENT PERFORMANCE CRITERIA TABLE

Matrix	Water				
Analytical Group	RP—Total Dissolved Solids				
Concentration Level	N/A				
Sampling Procedure¹	Analytical Method SOP²	DQIs	Measurement Performance Criteria	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A), or both (S&A)
S-5	A-10	Precision	≤20% RPD	Laboratory Duplicate	S & A
S-5	A-10	Accuracy/Bias, Contamination	< RL	Method Blank	A
S-5	A-10	Accuracy	88-110%	Laboratory Control Sample	A
S-5	A-10	Completeness	≥90%	Data completeness defined as data not qualified or rejected after validation	S & A

QAPP WORKSHEET #12 (CONTINUED)
MEASUREMENT PERFORMANCE CRITERIA TABLE

Matrix	Soil				
Analytical Group	RP—TOC				
Concentration Level	N/A				
Sampling Procedure¹	Analytical Method SOP²	DQIs	Measurement Performance Criteria	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A), or both (S&A)
S-1	A-11	Precision	≤50% RPD	Laboratory Duplicate	S & A
S-1	A-11	Accuracy	TOC, 75-125%R	MS/MSD	S & A
S-1	A-11	Precision	TOC, ≤35% RPD	MS/MSD	S & A
S-1	A-11	Accuracy/Bias, Contamination	<RL	Method Blank	A
S-1	A-11	Accuracy	TOC, 75-125%R	Laboratory Control Sample	A
S-1	A-11	Completeness	≥90%	Data completeness defined as data not qualified or rejected after validation	S & A

QAPP WORKSHEET #12 (CONTINUED)
MEASUREMENT PERFORMANCE CRITERIA TABLE

Matrix	Soil				
Analytical Group	RP—Particle Size, Hydraulic conductivity and Permeability, and Bulk Density and Porosity				
Concentration Level	N/A				
Sampling Procedure¹	Analytical Method SOP²	DQIs	Measurement Performance Criteria	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A), or both (S&A)
S-1	A-12, A-13, and A-14	Completeness	≥90%	Data completeness defined as data not qualified or rejected after validation	S & A

QAPP WORKSHEET #12 (CONTINUED)
MEASUREMENT PERFORMANCE CRITERIA TABLE

Matrix	Water				
Analytical Group	RP—Ferrous Iron				
Concentration Level	N/A				
Sampling Procedure¹	Analytical Method SOP²	DQIs	Measurement Performance Criteria	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A), or both (S&A)
S-5	A-15	Precision	≤20% RPD	Laboratory Duplicate	S & A
S-5	A-15	Accuracy/Bias, Contamination	< RL	Method Blank	A
S-5	A-15	Accuracy	75-125%	Laboratory Control Sample	A
S-5	A-15	Completeness	≥90%	Data completeness defined as data not qualified or rejected after validation	S & A

Notes:

Measurement performance criteria for soil, sediment, and water analyzed by EPA contract laboratory program laboratories are presented in the East Troy Phase I Remedial Investigation sampling and analysis plan (SulTRAC 2010). Measurement performance criteria for vapor intrusion samples, including indoor air, sub-slab soil gas, and ambient air, are presented in the East Troy Vapor Intrusion Monitoring Program sampling and analysis plan (SulTRAC 2011).

DQI Data quality indicator
MS/MSD Matrix spike/matrix spike duplicate
QL Quantitation limit
%R Percent recovery
RP Remediation parameters
RPD Relative percent difference

¹ Reference number from QAPP Worksheet #21

² Reference number from QAPP Worksheet #23

³ VOCs in groundwater collected during high resolution site characterization groundwater profiling will be analyzed by a National Environmental Laboratory Accreditation Program (NELAP)-certified on-site subcontracted laboratory. If the QC limits are different for the subcontracted laboratory, an updated VOCs/Water table will be added to this worksheet. The updated table will be submitted once the subcontracted lab has been identified.

⁴ The measurement performance criteria for dissolved gases analysis will be superseded by statistically-derived control limits generated by the laboratory and periodically updated/modified.

QAPP WORKSHEET #13
SECONDARY DATA CRITERIA AND LIMITATIONS TABLE

Secondary Data	Data Source (Originating Organization, Report Title, and Date)	Data Source (Originating Org, Data Types, data Generation/ Collection Dates)	How data will be used	Limitation on Data Use
Soil and groundwater	Shaw Environmental, Inc. "Supplemental Soil and Groundwater Delineation Report, Spinnaker Coatings, Inc., Facility, 518 East Water Street, Troy, Ohio." Prepared for K-C. October 2006.	Shaw Environmental, Inc.	This soil and groundwater information was used to evaluate nature and extent of contamination at the Spinnaker Facility.	Level IV laboratory QC data are not available; therefore, the data will not be used for the risk assessment
Groundwater	Quarterly VOC groundwater monitoring data for the Spinnaker Site	K-C	The data may be used in conjunction with RI data to evaluate nature and extent of contamination at the Spinnaker Facility.	Level IV laboratory QC data are not available; therefore, the data will not be used for the risk assessment
Groundwater	Ohio EPA. Laboratory analytical report and location data for groundwater samples collected using a Geoprobe on July 26, 2007, along levee near northwest corner of Spinnaker building. Provide to SulTRAC by Randy Watterworth, Ohio EPA, via e-mail on July 3, 2013.	Ohio EPA	This information was used to determine the high resolution site characterization groundwater profiling locations and may be used in conjunction with RI data to evaluate nature and extent of contamination at the Spinnaker Facility.	Level IV laboratory QC data are not available; therefore, the data will not be used for the risk assessment

Notes:

EPA U.S. Environmental Protection Agency
K-C Kimberly Clark, Inc.
QC Quality control
VOC Volatile organic compounds

QAPP WORKSHEET #14 SUMMARY OF PROJECT TASKS

Sampling Tasks:

1. Collecting 33 surface soil samples at 29 locations at the Hobart and Spinnaker and 432 East Main potential source areas
2. Collecting 45 subsurface soil samples from 20 locations at the Hobart and Spinnaker and 432 East Main potential source areas
3. Potentially collecting subsurface soil samples at the 10 East Main Street Residential Plume potential source area if MIP investigation results indicate that soil contamination is present in this area
4. Performing HRSC direct push multilevel groundwater profiling at 34 initial locations and possibly at nine contingency locations the following potential source areas located within the Residential Area and Water Street Plumes: 10 East Main Street, , 432 East Main Street, Clay and Franklin Streets, Hobart, and Spinnaker, as well as, the area southeast of Spinnaker
5. Collecting seven sub-slab vapor and indoor air samples and three ambient air samples in from 10 East Main Street and 432 East Main Street
6. Installing one new monitoring well at the leading edge of the Residential Area Plume
7. Collecting two groundwater samples from a new monitoring well installed at the leading edge of the Residential Area Plume
8. Collecting seven soil and ten groundwater samples to facilitate evaluation of remedial alternatives in the feasibility study.
9. Collecting four surface water samples from two locations on the Great Miami River
10. Collecting four sediment samples from two locations of the Great Miami River
11. Performing three rounds of water elevation surveys of groundwater monitoring locations
12. Conduct elevation surveys at newly installed monitoring wells and up to 20 existing Spinnaker monitoring wells.
13. Performing a survey of private well use in the area

Analysis Tasks: The following samples will be submitted to an EPA CLP laboratory for analysis of VOCs:

1. 33 surface soil samples
2. 45 subsurface soil samples
3. Potential subsurface soil samples at the 10 East Main Street
4. Two groundwater samples collected from a new monitoring well located at the leading edge of the Residential Area Plume
5. Ten groundwater samples collected from eight groundwater remediation parameter locations
6. Four surface water samples from the Great Miami River
7. Four sediment samples from the Great Miami River

705 groundwater samples collected during HRSC groundwater profiling wells will be analyzed for VOCs by an on-site laboratory. Seven sub-slab vapor and indoor air samples and three ambient air samples will be analyzed for VOCs by an off-site laboratory. Eight groundwater samples will be analyzed by TestAmerica, Inc., for the following remediation parameters: anions (chloride, sulfate, nitrate, fluoride, and bromide), ferrous iron, dissolved gases (methane, ethane, and ethene), total organic carbon, alkalinity, and total dissolved solids. In addition, chloride analysis will be conducted for groundwater samples collected from upgradient monitoring wells EPA-108S and EPA-122S. Seven soil samples will be analyzed by an off-site laboratory for the following remediation parameters: total organic carbon, grain size/particle size distribution, hydraulic conductivity, soil permeability, bulk soil density, and porosity.

QAPP WORKSHEET #14 (CONTINUED)
SUMMARY OF PROJECT TASKS

QC Tasks: The following QC samples will be collected and analyzed during the sampling event: field duplicates, matrix spike (MS)/matrix spike duplicate (MSD) samples, rinsate blanks, and trip blanks.

Secondary Data: See Worksheet #13

Data Management Tasks: SulTRAC will archive analytical data in an electronic database after validation.

Documentation and Records: All samples collected will be documented in a logbook or on field data sheets using a ballpoint pen. The time of collection, identification number, sampling location, field observations, sampler's name, and analyses will be recorded for each sample. Each page of the logbook will be dated, numbered, and signed by SulTRAC personnel. Field data records will be maintained at SulTRAC's Chicago office. SulTRAC will follow custody procedures outlined in SulTRAC's program-level Quality Assurance Project Plan (QAPP) for the RAC 2 contract. Further specifications are described in the Field Sampling Plan (FSP), Attachment A of this Sampling and Analysis Plan.

Assessment/Audit Tasks: No field or laboratory audits are currently planned.

Data Review Tasks: EPA will perform limited computer-aided data review and evaluation (CADRE) for all CLP data and will prepare a case narrative detailing any issues or inconsistencies discovered. The SulTRAC project manager will review the case narrative and will detail any analytical issues that may affect data quality in the RI/ FS report. The SulTRAC analytical coordinator or a SulTRAC chemist will validate data generated by subcontracted laboratories.

QAPP WORKSHEET #15
REFERENCE LIMITS AND EVALUATION TABLE

Reference Limits Table –Water (On-Site Laboratory)

Analytical Group	Analyte	CAS Number	Project Action Limit – Water (µg/L)	Minimum Reporting Limit - Water (µg/L) ¹
VOC	Vinyl chloride	75-01-4	2.0E+00 ²	TBD
VOC	Chloroethane	75-00-3	2.1E+03 ³	TBD
VOC	1,1-Dichloroethene	75-35-4	7.0E+00 ²	TBD
VOC	trans-1,2-Dichloroethene	156-50-5	8.6E+01 ³	TBD
VOC	1,1-Dichloroethane	75-34-3	2.4E+00 ³	TBD
VOC	cis-1,2-Dichloroethene	156-59-2	2.8E+01 ³	TBD
VOC	1,1,1-Trichloroethane	71-55-6	2.0E+02 ²	TBD
VOC	Benzene	71-43-2	3.9E-01 ³	TBD
VOC	1,2-Dichloroethane	107-06-2	1.5E-01 ³	TBD
VOC	Trichloroethene	79-01-6	4.4E-01 ³	TBD
VOC	Toluene	108-88-3	8.6E+02 ³	TBD
VOC	1,1,2-Trichloroethane	79-00-5	2.4E-01 ³	TBD
VOC	Tetrachloroethene	127-18-4	5.0E+00 ²	TBD
VOC	Ethylbenzene	100-41-4	1.3E+00 ³	TBD
VOC	o-Xylene	95-47-6	1.9E+02 ³	TBD
VOC	m,p-Xylene	179601-23-1	1.9E+02 ³	TBD
VOC	1,1,2,2-Tetrachloroethane	79-34-5	6.6E-02 ³	TBD

QAPP WORKSHEET #15 (CONTINUED)
REFERENCE LIMITS AND EVALUATION TABLE

Reference Limits Table – Remediation Parameters

Analytical Group	Analyte	CAS Number	Project Action Limit – Water (µg/L)	Minimum Required Reporting Limit - Water (µg/L)¹
Remediation Parameter	Nitrate	14797-55-8	1.0E+03 ⁴	1.0E+02
Remediation Parameter	Bromide	7726-95-6	NC	5.0E+02
Remediation Parameter	Fluoride	16984-48-8	NC	1.0E+03
Remediation Parameter	Chloride	16887-00-6	Twice background ⁴	1.0E+03
Remediation Parameter	Sulfate	18785-72-3	2.0E+04 ⁴	1.0E+03
Remediation Parameter	Ferrous iron	15438-31-0	1.0E+03 ⁴	5.0E+01
Remediation Parameter	Methane	74-82-8	5.0E+02 ⁴	5.0E-01
Remediation Parameter	Ethane	74-84-0	1.0E+01 ⁴	5.0E-01
Remediation Parameter	Ethene	74-85-1	1.0E+01 ⁴	5.0E-01
Remediation Parameter	Total organic carbon (TOC) – Water	7440-44-0	2.0E+04 ⁴	1.0E+03
Remediation Parameter	Alkalinity, total	10-16-4	NC	5.0E+03
Remediation Parameter	Total dissolved solids (TDS)	10-05-2	NC	1.0E+04
Remediation Parameter	Total organic carbon (TOC) - Soil	7440-44-0	NC	200 mg/kg ⁵

Notes:

Reference limits for soil, sediment, and water analyzed by EPA contract laboratory program laboratories are presented in the East Troy Phase I Remedial Investigation sampling and analysis plan (SulTRAC 2010). Reference limits for vapor intrusion samples, including indoor air, sub-slab soil gas, and ambient air, are presented in the East Troy Vapor Intrusion Monitoring Program sampling and analysis plan (SulTRAC 2011).

µg/L Microgram per liter
CAS Chemical Abstract Services
CRQL Contract-required quantitation limit
NC No criteria
TBD To be determined
VOC Volatile organic compound

- ¹ For VOCs, the minimum required reporting limit will be obtained once the on-site laboratory is determined. For remediation parameters, the minimum required detection limit was obtained from TestAmerica, Inc.
- ² Maximum contaminant level (MCL), EPA. Drinking Water Standards and Health Advisories
- ³ U.S. EPA Regional Screening Levels for Chemical Contaminants at Superfund Sites, June 2013 (EPA 2013). The tap water limits are listed.
- ⁴ Minimum quantitation limits for evaluation of monitored natural attenuation of groundwater (EPA 1998).
- ⁵ For TOC in soil, the minimum required reporting limit is from Method 9060.

QAPP WORKSHEET #16
PROJECT SCHEDULE/TIMELINE TABLE

Activity	Organization	Date ¹		Deliverable	Deliverable Due Date
		Anticipated Date of Initiation	Anticipated Date of Completion		
Field sampling	SulTRAC	November 2013	December 2013	Remedial Investigation Report	60 days after receipt of last set of validated data

Note:

¹ Initiation and completion dates based upon availability of subcontractors and SAP approval.

QAPP WORKSHEET #17 SAMPLING DESIGN AND RATIONALE

Describe the sampling design and rationale in terms of what matrices will be sampled, what analytical groups will be analyzed and at what concentration levels, the sampling locations (including QC, critical, and background samples), the number of samples to be collected, and the sampling frequency (including seasonal considerations). (May refer to map or Worksheet #18 for details).

SulTRAC will conduct a membrane interface probe (MIP) investigation prior to the expanded Phase II RI activities included in this QAPP. The scope and procedures of the MIP investigation are detailed in the MIP Investigation Sampling Plan (SulTRAC 2013). MIP is a high resolution site characterization (HRSC) technique that will be used to obtain a higher density of screening level data at the suspected source areas. The results of the MIP investigation will likely alter the number and locations of soil and groundwater samples collected as part of this expanded Phase II RI. Therefore, the sample numbers and locations presented in this SAP are estimates and actual numbers and locations may vary.

Source Characterization - Soil

Surface and subsurface soil samples will be collected to delineate the nature and extent of contamination at potential source areas. A total of 28 surface soil samples will be collected at 25 locations at the Hobart and Spinnaker potential source areas. Both Hobart and Spinnaker are Water Street Plume potential source areas. Four surface soil samples (0 to 6 inches bgs) will be collected from the eastern portion of the Hobart property for evaluation of current and future potential exposure scenarios. Surface soil locations will be collected where visual evidence, odors, or PID screening indicates surficial contamination. In addition, one surface soil sample will be collected from each of two sub-slab soil boring locations. The surface soil samples will be collected from 0 to 6 inches bgs, immediately beneath the building slab. Sub-slab soil borings will be located beneath the loading dock area, where elevated concentrations of chlorinated solvents have been detected, and in the vicinity of the former vapor degreaser. In addition, eight surface soil samples will be collected from soil borings in the vicinity of the loading dock to further delineate the nature and extent of soil contamination previously identified in this area. At Spinnaker, three surface soil samples (0 to 6 inches bgs) will be collected from the unpaved area between the building and the levee for evaluation of current and future potential exposure scenarios. The remaining on-site areas are paved. Furthermore, one surface soil sample will be collected from each of two sub-slab soil boring locations. The surface soil samples will be collected from 0 to 6 inches bgs, immediately beneath the building slab. Sub-slab soil borings will be located near the northwestern corner of the building, where elevated contaminant concentrations have been detected outside the building. In addition, one surface soil sample will be collected from each of six soil boring locations installed in the parking lot area to further define the nature and extent of contamination in areas where no RI or other soil data exists.

Additional subsurface soil samples may be collected at the 10 East Main Street Residential Plume potential source area if MIP investigation results indicate that soil contamination is present in this area. At 432 East Main, two sub-slab soil samples will be collected indoors near a floor drain that may have been used to dispose of dry cleaning fluids. Two surface soil samples will be collected outdoors near exhaust fans.

A total of 40 subsurface soil samples will be collected from 18 locations at the Hobart and Spinnaker potential source areas. At Hobart, two subsurface soil samples will be collected in each of two sub-slab soil boring locations at two additional depth intervals between the uppermost surface soil sample and the water table (expected to be about 12 to 15 feet bgs). One sub-slab boring is planned beneath the loading dock and one in the vicinity of the former vapor degreaser near the central portion of the Hobart building. Eight soil borings will be installed in the vicinity of the loading dock area to further delineate the nature and extent of soil contamination previously identified in this area. Two subsurface soil samples will be collected in each of the eight soil boring

QAPP WORKSHEET #17 (CONTINUED)

SAMPLING DESIGN AND RATIONALE

locations at two additional depth intervals between the uppermost surface soil sample and the water table (expected to be about 12 to 15 feet bgs). At Spinnaker, two subsurface soil samples will be collected in each of two sub-slab soil boring locations at two additional depth intervals between the uppermost surface soil sample (listed above) and the water table (expected to be about 12 to 15 feet bgs). Two sub-slab borings are planned near the northwestern portion of the building, where elevated contaminant concentrations have been detected outside the building. Six soil borings will be installed in the parking lot area to further define the nature and extent of contamination in areas where no RI or other soil data collected by Spinnaker exist. Two subsurface soil samples will be collected in each of six sub-slab soil boring locations at two additional depth intervals between the uppermost surface soil sample (listed above) and the water table (expected to be about 12 to 15 feet bgs). Subsurface soil samples will be collected at depth intervals where visual evidence, odors, or PID screening indicates soil contamination. Surface and subsurface soil samples will be analyzed for VOCs through the EPA CLP. The procedures for collection and analysis of soil samples are presented in SulTRAC's Phase I RI QAPP (SulTRAC 2010).

Source Characterization - Groundwater

SulTRAC will conduct HRSC direct-push multilevel groundwater profiling at the following potential source areas located within the Residential Area and Water Street Plumes: 10 East Main Street, 432 East Main Street, Clay and Franklin Streets, Hobart, and Spinnaker. The purpose of the groundwater profiling samples is to determine if additional primary or secondary (such as contaminants sorbed to lower permeability deposits or within the zone of groundwater fluctuation) source material exists in the vicinity of the potential source areas and to evaluate associated release and transport mechanisms. Groundwater samples will be analyzed on-site for target VOCs using a mobile laboratory for fast turnaround. Target VOCs for the Residential Area and Water Street Plumes include cis-1,2-DCE, PCE, TCE, vinyl chloride. Target VOCs for the Water Street Plume also include BTEX, 1,1,1- TCA, 1,1,2-TCA, and 1,1-DCA. Water Street Plume groundwater profiling samples will include TCA, DCA, and BTEX only at select locations which will be identified based on previous soil and groundwater data. Mobile laboratory results may be used to guide or modify subsequent HRSC sampling locations. HRSC groundwater profiling will also provide detailed data relative to the distribution of hydraulic conductivity and hydraulic head, pH, specific conductance, dissolved oxygen, and ORP to correlate VOC concentrations with these other parameters.

HRSC groundwater profiling will be conducted at an estimated 27 initial locations and possibly at eight contingency locations. Groundwater samples are initially planned at 5-foot intervals to a depth of 80 feet bgs. Therefore, a total of 574 groundwater samples are estimated at the potential source areas. However, actual sample locations, numbers, depths, and sampling intervals will be adjusted based on MIP results. At 10 East Main Street, four groundwater profiling locations are planned on the west side of Walnut Street near previous groundwater Geoprobe samples WAL-1, WAL-2, and BW001-WAL, which contained PCE concentrations above the MCL and VISL. In addition, three groundwater profiling locations are planned on the east side of Walnut Street in the vicinity of monitoring wells OEPA-11 and EPA-107I, which contained PCE and TCE above the MCL and VISL. At Clay and Franklin, four groundwater profiling locations are planned on the east side of Clay Street near Franklin Street in the vicinity of monitoring wells OEPA -7 and EPA-119I, which contained PCE concentrations above the MCL and VISL. Well OEPA-7 typically contains some of the highest concentrations of PCE within the residential area groundwater plume. At 432 East Main Street, one groundwater profiling location is planned adjacent to the building along Union Street in the vicinity of monitoring well EPA-103S, which contains a PCE concentration above the MCL and VISL. An additional three groundwater profiling locations are planned adjacent to the building along Union Street to determine if source material is migrating from this former dry cleaning location. At Hobart, two groundwater profiling locations are planned adjacent to loading dock, north of the building, where elevated concentrations of chlorinated solvents have been detected in soil. Two groundwater profiling locations are planned on the south side of the building, near the former vapor degreaser. At Spinnaker, six groundwater profiling locations are planned near the northwestern corner of the building, where elevated concentrations of cis-1,2-DCE (detected in City of Troy production wells across the river) and other chlorinated solvents have been detected. Two groundwater profiling locations are

QAPP WORKSHEET #17 (CONTINUED)

SAMPLING DESIGN AND RATIONALE

planned in the southern portion of the Spinnaker parking lot where a dry cleaner was formerly located.

In addition, seven groundwater profiling locations and one contingent location are planned southeast of Spinnaker along the river, across from the Troy production well where cis-1,2-DCE has been detected, to determine if and where groundwater contamination may be migrating under the river.

Other Areas of Investigation

SulTRAC will collect seven sub-slab vapor and indoor air samples and three ambient air samples in from 10 East Main Street and 432 East Main Street. Vapor intrusion monitoring was not conducted at these potential source areas previously as a result of access restrictions. Air samples will be analyzed for VOCs by an off-site laboratory. The procedures for collection and analysis of vapor intrusion samples are presented in SulTRAC's vapor intrusion monitoring program QAPP for the ETCA site (SulTRAC 2011).

SulTRAC will collect four sediment and four surface water samples from two locations in the Great Miami River to determine if the groundwater plume is contaminating the river southeast of Spinnaker. Previous sediment and surface water samples collected during Phase I investigations did not evaluate this portion of the Water Street Plume because the extent of the plume was not known during Phase I. Surface water and sediment samples will be analyzed for VOCs through the EPA CLP. The procedures for collection and analysis of sediment and surface water samples are presented in SulTRAC's Phase I RI QAPP (SulTRAC 2010).

SulTRAC will collect two groundwater samples from a new monitoring well installed at the leading edge of the Residential Area Plume. The groundwater samples will be analyzed for VOCs through the EPA CLP. The procedures for collection and analysis of groundwater samples are presented in SulTRAC's Phase I RI QAPP (SulTRAC 2010).

SulTRAC will collect three rounds of groundwater elevation measurements during the expanded Phase II investigation. These will include, at least one set of measurements concurrent with a period when the City of Troy is using at least one of each of the production wells in which low levels of VOCs have been detected. These include wells P-14, P-18 and P-17.

SulTRAC will also conduct elevation surveys at the newly installed monitoring wells, as well as, up to 20 Spinnaker monitoring wells that have not been previously surveyed by EPA. Finally, SulTRAC will survey residents regarding private well use because of anecdotal evidence of residents using hand-dug wells for irrigation.

Remediation Parameters

Soil and groundwater samples will be collected to facilitate evaluation of remedial alternatives in the FS. Soil parameters will evaluate the potential effectiveness of in situ remediation technologies in saturated and unsaturated zones. Soil remediation parameters include total organic carbon, grain size/particle size distribution, hydraulic conductivity, soil permeability, bulk soil density, and porosity. Residential plume area soil remediation parameter sample locations are located near monitoring wells EPA-107I and OEPA-7, where the highest PCE concentrations have historically been detected. Near well EPA-107I, soil samples will be collected at about 20 and 50 feet bgs because significant contaminant concentrations have been detected at both depths and the hydrogeologic units at each of these depths are different. Near well OEPA-7, soil samples will also be collected from the sand and gravel unit at about 20 feet bgs and the clayey gravel unit at about 50 feet bgs. Spinnaker area soil remediation parameter samples will be collected from one soil boring near the former chemical storage area near the center of the parking lot at depths of about 5 feet (fill material), 10 feet (clay), and 20 feet bgs (sand and gravel).

QAPP WORKSHEET #17 (CONTINUED)

SAMPLING DESIGN AND RATIONALE

Actual samples depths may be modified in the field to ensure that samples are collected from each of the three strata that underlie the site.

Groundwater remediation parameters will evaluate the effectiveness of natural attenuation and other in situ remediation technologies. Groundwater remediation parameters include anions (chloride, sulfate, nitrate, fluoride, and bromide), ferrous iron, dissolved gases (methane, ethane, and ethene), total organic carbon, alkalinity, and total dissolved solids. The following groundwater field parameters will be collected from each well where remediation parameter sampling will be conducted: temperature, pH, specific conductance, dissolved oxygen, and ORP. Residential plume area groundwater remediation parameter sample locations are monitoring wells EPA-107I, EPA-116S, and OEPA-7. These wells are located in the western, central, and eastern portions of the Residential Area Groundwater Plume. The highest PCE concentrations have historically been detected at wells EPA-107I and OEPA-7. Hobart area groundwater remediation parameter samples will be collected from monitoring well EPA-110S, located near the center of the property. Spinnaker area groundwater remediation parameter samples will be collected from monitoring wells OEPA-3 and KMW-10. Elevated contaminant concentrations have been detected in both locations. Also, VOC analysis will also be conducted at each of the groundwater remediation parameter locations to evaluate the relationship between remediation parameters and VOC contaminant concentrations. In addition, chloride analysis will be conducted for groundwater samples collected from upgradient monitoring wells EPA-108S and EPA-122S.

SulTRAC will assess data from the soil, surface water, sediment, groundwater, sub-slab vapor, and indoor air samples for the analytical groups listed above to delineate the contamination present at the East Troy Site.

Notes:

CLP	Contract Laboratory Program
EPA	U.S. Environmental Protection Agency
HRSC	High resolution site characterization
VOC	Volatile organic compound

QAPP WORKSHEET #18
SAMPLING LOCATIONS/IDS, SAMPLE DEPTHS, SAMPLE ANALYSES
AND SAMPLING PROCEDURES TABLE

Sampling Location/ ID Number¹	Matrix	Depth (feet bgs)	Analytical Group	Sampling SOP Reference
10 East Main – Subsurface soil samples potential based on MIP results Hobart – 14 surface soil and 10 subsurface soil sample locations (up to 3 depths each at subsurface soil sample locations) Spinnaker – 11 surface soil and 8 subsurface soil sample locations (up to 3 depths each at subsurface soil sample locations)	Soil	Various	CLP SOW SOM01.2 (VOCs)	S-1
2 locations Great Miami River	Surface Water	0-1	CLP SOW SOM01.2 (VOCs)	S-6
2 locations Great Miami River	Sediment	0-1	CLP SOW SOM01.2 (VOCs)	S-2
3 Sub-slab, 3 indoor air and 1 ambient air locations at each 10 East Main and 432 East Main Street	Sub-slab vapor, indoor air, and ambient air	1 for sub-slab vapor samples, NA for indoor and ambient air	Method TO-15 (VOCs)	S-9, S-10 and S-11
9 locations (One new well at leading edge of Residential Area plume and eight groundwater remediation parameter sampling locations)	Groundwater	TBD and Various	CLP SOW SOM01.2 (VOCs)	S-5

QAPP WORKSHEET #18 (CONTINUED)
SAMPLING LOCATIONS/IDS, SAMPLE DEPTHS, SAMPLE ANALYSES
AND SAMPLING PROCEDURES TABLE

Sampling Location/ ID Number¹	Matrix	Depth (feet bgs)	Analytical Group	Sampling SOP Reference
<p>High resolution site characterization direct push multilevel groundwater profiling</p> <p>10 East Main – 7 initial and 2 contingency locations</p> <p>432 East Main – 4 initial and 1 contingency location</p> <p>Hobart – 4 initial and 2 contingency</p> <p>Spinnaker – 8 initial and 2 contingency</p> <p>Clay and Franklin – 4 initial and 1 contingency</p> <p>Area Southeast of Spinnaker – 7 initial and 1 contingency</p>	Groundwater (profiling)	Every 5 feet to a maximum of 80 feet or top of aquitard ¹	EPA Method 8260 (VOCs)	S-5
<p>Remediation Parameters</p> <p>Residential Area Plume – 2 locations at 2 depths</p> <p>Spinnaker – 1 location at 3 depths</p>	Soil	<p>Approximately 20 feet bgs (sand and gravel) and 50 feet bgs (clay)</p> <p>Approximately 5 feet bgs (fill), 10 feet bgs (clay), and 20 feet bgs (sand and gravel)</p>	<p>EPA SW-846 – 9060A (total organic carbon)</p> <p>ASTM D422 (sand/gravel fraction)</p> <p>ASTM D5084 (Hydraulic conductivity and soil permeability)</p> <p>ASTM D7263 (Bulk soil density and porosity)</p>	S-12

QAPP WORKSHEET #18 (CONTINUED)
SAMPLING LOCATIONS/IDS, SAMPLE DEPTHS, SAMPLE ANALYSES
AND SAMPLING PROCEDURES TABLE

Sampling Location/ ID Number¹	Matrix	Depth (feet bgs)	Analytical Group	Sampling SOP Reference
Remediation Parameters Residential Area Plume – 4 locations Hobart – 2 locations Spinnaker – 2 locations	Groundwater	Various	EPA Method 300.0 (Anions – chloride, sulfate, nitrate, fluoride, bromide) EPA Method RSK-175 (Dissolved Gases - Methane, Ethane, Ethene) Method 5310C (Total organic carbon) Method 2320B (alkalinity) Method 2540C (Total dissolved solids) Method SM 3500-Fe B (Ferrous iron)	S-5

Notes:

bgs Below ground surface
CLP Contract Laboratory Program
ID Identification
NA Not applicable
SOW Statement of Work

¹ See the Field Sampling Plan in Attachment A of this Sampling and Analysis Plan for sample locations and IDs.

QAPP WORKSHEET #19
ANALYTICAL METHODS, CONTAINERS, PRESERVATIVES, AND HOLDING TIMES TABLE

Matrix	Analytical Group	Analytical and Preparation Method	Containers (number, size, type)	Preservation Requirements (chemical, temperature, etc.)	Maximum Holding Time (preparation/analysis)¹
Soil, Sediment	VOCs	A-1	Three 40-mL glass containers with PTFE-lined septa and open-top screw caps, pre-weighted and containing magnetic stir bars, and one 2 ounce container of sample filled with no headspace for determination of moisture content.	Cool to 4 °C ± 2 °C immediately after collection	48 hours to preservation at laboratory/14 days for analysis following preservation
Water	VOCs	A-1, A-4	Three 40-mL glass vials with PTFE-lined septa and open-top screw caps	No headspace; cool to 4 °C ± 2 °C; adjust pH to less than 2 with HCl	7 days/14 days
Air (Sub-Slab Vapor, Indoor Air, and Ambient Air)	VOCs	A-5	One 6-liter stainless steel Summa canister and SIM-certified 24-hour flow controller.	None. Shipped in the shipping containers they were received in.	30 days

QAPP WORKSHEET #19 (CONTINUED)
ANALYTICAL METHODS, CONTAINERS, PRESERVATIVES, AND HOLDING TIMES TABLE

Matrix	Analytical Group	Analytical and Preparation Method	Containers (number, size, type)	Preservation Requirements (chemical, temperature, etc.)	Maximum Holding Time (preparation/analysis) ¹
Water	RP-Inorganic Ions	A-6	One 500-mL plastic bottle OR one 1-Liter plastic bottle for RP-inorganic ions, RP-TDS, and RP-ferrous iron	Cool to 4±2°C Immediately after collection	28 Days
Water	RP-Dissolved Gases	A-7	Three 40-mL glass vials with PTFE-lined septa and open-top screw caps	No Headspace Adjust pH to <2 with HCl Cool to 4±2°C Immediately after collection	14 Days
Water	RP-TOC	A-8	Two 40-mL glass vials with PTFE-lined septa and open-top screw caps	H ₂ SO ₄ to pH < 2 and cool to 4±2°C Immediately after collection	28 Days
Water	RP-Alkalinity	A-9	One 250-mL plastic bottle	Cool to 4±2°C Immediately after collection	14 Days
Water	RP-TDS	A-10	One 500-mL plastic bottle OR one 1-Liter plastic bottle for RP-inorganic ions, RP-TDS, and RP-ferrous iron	Cool to 4±2°C Immediately after collection	7 Days
Water	RP-Ferrous Iron	A-15	One 250-mL plastic bottle OR one 1-Liter plastic bottle for RP-inorganic ions, RP-TDS, and RP-ferrous iron	Cool to 4±2°C Immediately after collection	24 Hours
Soil	RP-TOC	A-11	One 4-oz wide mouth glass jar fitted with PTFE-lined screw cap	Cool to 4±2°C Immediately after collection	28 Days
Soil	RP-Particle Size	A-12	One 8-oz wide mouth glass jar fitted with polyethylene screw cap	None	None
Soil	RP-Hydraulic Conductivity and Permeability	A-13	One Shelby tube, capped	None	None
Soil	RP-Bulk Density and Porosity	A-14	One Shelby tube, capped	None	None

Notes:

HCl Hydrochloric acid
H₂SO₄ Sulfuric acid
HDPE High-density polyethylene
mL Milliliter

NA Not applicable
PTFE Polytetrafluoroethylene
RP Remediation parameter
TBD To be determined

¹ Holding time is applicable from validated time of sample receipt and is measured to time of sample extraction and analysis.

QAPP WORKSHEET #20 C
FIELD QUALITY CONTROL SAMPLE SUMMARY TABLE FOR SOURCE CHARACTERIZATION ACTIVITIES

Matrix	Analytical Group	Analytical and Preparation SOP Reference ¹	No. of Sampling Locations	No. of Samples	No. of Field Duplicates ²	No. of MS/MSDs ³	No. of Trip Blanks ⁴	No. of Equipment Rinsates	Total No. of Samples to Laboratory
10 East Main Street									
Subsurface Soil ⁵	CLP VOCs	A-1	TBD based on MIP results	TBD	1 for every 10 soil samples	1 for every 20 soil samples	0	0	TBD
Sub-slab vapor	VOCs	A-5	3	3	1	0	0	0	4
Indoor air	VOCs	A-5	3	3	0	0	0	0	3
Ambient air	VOCs	A-5	1	1	1	0	0	0	2
Groundwater (HRSC direct push multilevel profiling)	cis-1,2-DCE, PCE, TCE, vinyl chloride	A-4	9, including 2 contingency locations	126	13	6	0	9	148
432 East Main Street									
Surface Soil	CLP VOCs	A-1	4	4	1	0	0	0	5
Subsurface Soil	CLP VOCs	A-1	2	4	1	0	0	0	5
Sub-slab vapor	VOCs	A-5	3	3	0	0	0	0	3
Indoor air	VOCs	A-5	3	3	1	0	0	0	4
Ambient air	VOCs	A-5	1	1	0	0	0	0	1
Groundwater (HRSC direct push multilevel profiling)	cis-1,2-DCE, PCE, TCE, vinyl chloride	A-4	5, including 1 contingency location	70	7	4	0	5	82
Hobart									
Surface Soil ⁵	CLP VOCs	A-1	14	14	2	0	0	0	16
Subsurface Soil ⁵	CLP VOCs	A-1	10	20	2	1	0	0	22
Groundwater (HRSC direct push multilevel profiling) ⁵	cis-1,2-DCE, PCE, TCE, 1,1,2-TCA, DCA, vinyl chloride, BTEX	A-4	6, including 2 contingency locations	84	8	4	0	6	98

QAPP WORKSHEET #20 C (CONTINUED)
FIELD QUALITY CONTROL SAMPLE SUMMARY TABLE FOR SITE CHARACTERIZATION ACTIVITIES

Matrix	Analytical Group	Analytical and Preparation SOP Reference ¹	No. of Sampling Locations	No. of Samples	No. of Field Duplicates ²	No. of MS/MSDs ³	No. of Trip Blanks ⁴	No. of Equipment Rinsates	Total No. of Samples to Laboratory
Spinnaker									
Surface Soil ⁵	CLP VOCs	A-1	11	11	1	0	0	0	12
Subsurface Soil ⁵	CLP VOCs	A-1	8	16	2	1	0	0	18
Groundwater (HRSC direct push multilevel profiling) ⁵	cis-1,2-DCE, PCE, TCE, 1,1,1-TCA, DCA, vinyl chloride, BTEX	A-4	10, including 2 contingency locations	140	14	7	0	10	164
Franklin/Clay Street Area									
Groundwater (HRSC direct push multilevel profiling) ⁵	cis-1,2-DCE, PCE, TCE, vinyl chloride	A-4	5, including 1 contingency location	70	7	4	0	5	82
Area Southeast of Spinnaker									
Groundwater (HRSC direct push multilevel profiling) ⁵	cis-1,2-DCE, PCE, TCE, vinyl chloride	A-4	8, including 1 contingency location	112	11	6	0	8	131
Residential Area Plume (New Monitoring Well)									
Groundwater	CLP VOCs	A-1	1	1	1	1	1	0	2
Residential Area and Water Street Plumes (Groundwater Remediation Parameter Sampling Locations)									
Groundwater	CLP VOCs	A-1	8	8	1	1	1	1	10
Sediment and Surface Water									
Sediment	CLP VOCs	A-1	2	2	1	1	0	1	4
Surface Water	CLP VOCs	A-1	2	2	1	1	1	0	4

Notes:

Sample numbers in this table reflect field QC samples collected during each sampling event.

¹ Analytical and preparation SOPs are listed in Worksheet #23.

² Field duplicates are collected at a rate of 1 per 10 investigative samples of the same matrix.

³ MS/MSD samples are collected at a rate of 1 per 20 investigative samples of the same matrix. MS/MSDs consist of extra sample volume and are not included in the total number of samples. MS/MSD samples are not applicable to indoor air, ambient air, or sub-surface vapor samples collected by Summa canisters.

⁴ A trip blank will be provided with each shipping container with water samples to be analyzed for VOCs. No trip blanks will be collected for HRSC samples because the samples will be analyzed by an on-site laboratory and not shipped off site.

QAPP WORKSHEET #20 C (CONTINUED)
FIELD QUALITY CONTROL SAMPLE SUMMARY TABLE FOR SITE CHARACTERIZATION ACTIVITIES

⁵ The location and number of surface and subsurface soil and groundwater profiling samples may be modified based on membrane interface probe sampling (MIP) conducted prior to implementing the expanded Phase II remedial investigation activities outlined in this QAPP. MIP sampling activities are being conducted pursuant to the MIP Sampling Plan (SulTRAC 2013). Hobart and Spinnaker groundwater profiling samples will include TCA, DCA, and BTEX only at select locations which will be identified based on previous soil and groundwater data.

BTEX	Benzene, toluene, ethyl benzene, and xylene
CLP	Contract Laboratory Program
DCA	Dichloroethane
DCE	Dichloroethene
HRSC	High-resolution site characterization
PCE	Tetrachloroethene
TBD	To be determined
TCA	Trichloroethane
TCE	Trichloroethene
VOC	Volatile organic compound

QAPP WORKSHEET #20 RP
FIELD QUALITY CONTROL SAMPLE SUMMARY TABLE FOR REMEDIATION PARAMETER SAMPLING ACTIVITIES

Matrix	Analytical Group	Analytical and Preparation SOP Reference ¹	No. of Sampling Locations	No. of Samples	No. of Field Duplicates ²	No. of MS/MSDs ³	No. of Trip Blanks	No. of Equipment Rinsates	Total No. of Samples to Laboratory
Residential Area Groundwater Plume									
Groundwater ⁴	Anions – chloride, sulfate, nitrate, fluoride, and bromide	A-6	4	4	0	1 ⁵	0	1	5
	Ferrous Iron	A-15							
	Dissolved Gases (Methane, ethane, ethene)	A-7							
	Total organic carbon	A-8							
	Alkalinity	A-9							
	Total dissolved solids	A-10							
Soil ⁶	Total organic carbon	A-11	2	4	0	0	0	0	4
	Grain size/particle size distribution	A-12							
	Bulk soil density and porosity	A-14							
	Hydraulic conductivity and soil permeability	A-13		2					

QAPP WORKSHEET #20 RP (CONTINUED)
FIELD QUALITY CONTROL SAMPLE SUMMARY TABLE FOR REMEDIATION PARAMETER SAMPLING ACTIVITIES

Matrix	Analytical Group	Analytical and Preparation SOP Reference ¹	No. of Sampling Locations	No. of Samples	No. of Field Duplicates ²	No. of MS/MSDs ³	No. of Trip Blanks ⁴	No. of Equipment Rinsates	Total No. of Samples to Laboratory
Hobart									
Groundwater ⁷	Anions – chloride, sulfate, nitrate, fluoride, and bromide	A-6	2	2	1	0	0	0	3
	Ferrous Iron	A-15							
	Dissolved Gases (Methane, ethane, ethene)	A-7							
	Total organic carbon	A-8							
	Alkalinity	A-9							
	Total dissolved solids	A-10							
Spinnaker									
Groundwater ⁸	Anions – chloride, sulfate, nitrate, fluoride, and bromide	A-6	2	2	0	0	0	0	2
	Ferrous Iron	A-15							
	Dissolved Gases (Methane, ethane, ethene)	A-7							
	Total organic carbon	A-8							
	Alkalinity	A-9							
	Total dissolved solids	A-10							

QAPP WORKSHEET #20 RP (CONTINUED)
FIELD QUALITY CONTROL SAMPLE SUMMARY TABLE FOR REMEDIATION PARAMETER SAMPLING ACTIVITIES

Matrix	Analytical Group	Analytical and Preparation SOP Reference ¹	No. of Sampling Locations	No. of Samples	No. of Field Duplicates ²	No. of MS/MSDs ³	No. of Trip Blanks	No. of Equipment Rinsates	Total No. of Samples to Laboratory
Soil ⁹	Total organic carbon	A-11	1	3	0	1 ¹⁰	0	0	3
	Grain size/particle size distribution								
	Bulk soil density and porosity								
	Hydraulic conductivity and soil permeability			1					

Notes:

Sample numbers in this table reflect field QC samples collected during each sampling event.

¹ Analytical and preparation SOPs are listed in Worksheet #23.

² Field duplicates are collected at a rate of 1 per 10 investigative samples of the same matrix.

³ MS/MSD samples are collected at a rate of 1 per 20 investigative samples of the same matrix. MS/MSD samples consist of extra sample volume and are not included in the total number of samples.

⁴ Residential area plume groundwater remediation parameter sample locations are monitoring wells EPA-107I, EPA-116S, and OEPA-7. Chloride only will be collected at EPA-108S, an upgradient monitoring well.

⁵ MS/MSD to be collected only for total organic carbon and dissolved gases (methane, ethane, and ethene).

⁶ Residential area plume soil remediation parameter sample locations located near monitoring wells EPA-107I and OEPA-7 soil samples will be collected at about 20 and 50 feet below ground surface (bgs). Actual samples depths may be slightly modified in the field to ensure that samples are collected from each of the 2 strata that underlie this portion of the site. However, hydraulic conductivity and soil permeability will only be analyzed from low permeability material (clay).

⁷ Hobart area groundwater remediation parameter samples will be collected from monitoring well EPA-110S. Chloride only will be collected at EPA-122S, an upgradient monitoring well.

⁸ Spinnaker area groundwater remediation parameter samples will be collected from monitoring wells OEPA-3 and KMW-10.

⁹ Spinnaker area soil remediation parameter samples will be collected from one soil boring near the former chemical storage area near the center of the parking lot at depths of about 5 feet (fill material), 10 feet (clay), and 20 feet bgs (sand and gravel). Actual samples depths may be slightly modified in the field to ensure that samples are collected from each of the three strata that underlie the site. However, hydraulic conductivity and soil permeability will only be analyzed from low permeability material (clay).

¹⁰ MS/MSD to be collected only for total organic carbon.

MS Matrix spike

MSD Matrix spike duplicate

RP Remediation parameter

QAPP WORKSHEET #21
PROJECT SAMPLING SOP REFERENCES TABLE

Reference Number	Title, Revision, Date and/or Number	Originating Organization	Equipment Type	Modified for Project Work? (Y/N)	Comments
S-1	Soil Sampling, SOP 005	Tetra Tech EM Inc.	Spoon or spatulas, trowel, split-spoon sampler, coring tools	N	None
S-2	Sediment Sampling, Refer to Section 5.3 in Field Sampling Plan	Tetra Tech EM Inc.	Shelby tube drive head, probe drive Geoprobe Systems	N	None
S-3	Monitoring Well Installation, SOP 020	Tetra Tech EM Inc.	Casing materials, well screen materials, filter pack materials, annular sealant, grouting materials, tremie pipe, surface completion and protective casing materials, concrete surface pad and bumper post, uncontaminated water	N	None
S-4	Monitoring Well Development, SOP 021	Tetra Tech EM Inc.	Pumps, air compressors, bailers, surge blocks	N	None
S-5	Groundwater Sample Using Micropurge Technology, SOP 015	Tetra Tech EM Inc.	PID, water level indicator, adjustable flow rate pump, discharge flow controller, flow-through cell, pH probe, dissolved oxygen probe, turbidity meter, oxidation and reduction probe, sampling containers.	N	None
S-6	Surface Water Sampling, SOP 009	Tetra Tech EM Inc.	Sample bottles, dipper, or other device made of inert material (stainless steel or Teflon)	N	None
S-7	Packaging and Shipping Samples, SOP 019-5	Tetra Tech EM Inc.	Cooler, chain of custody form, shipping materials	N	None

QAPP WORKSHEET #21 (CONTINUED)
PROJECT SAMPLING SOP REFERENCES TABLE

Reference Number	Title, Revision, Date and/or Number	Originating Organization	Equipment Type	Modified for Project Work? (Y/N)	Comments
S-8	General Equipment Decontamination, SOP 002	Tetra Tech EM Inc.	Scrub brushes, large wash tubs or buckets, Alconox, distilled water	N	None
S-9	Construction and Installation of Permanent Subslab Soil Gas Ports, Ohio EPA SOP 2.5.2 – May 2010	Ohio EPA	Hammer drill, sampling port, sealer, cap	N	See Ohio EPA 2010 for complete guidance
S-10	Procedures for Collection of Indoor Air, Ohio EPA SOP 2.5.3 - May 2010	Ohio EPA	Summa Canister with pressure gauge, tubing	N	See Ohio EPA 2010 for complete guidance
S-11	Construction And Installation Of Permanent Sub-Slab Soil Gas Wells (EPA REAC SOP #2082) – March 2007	EPA-REAC	Hammer drill, sampling port, sealer, cap Summa Canister with pressure gauge, tubing	N	See EPA 2010 for complete guidance
S-12	Bulk Material Sampling, Revision No. 2, SOP 007	Tetra Tech EM Inc.	Trier, scoop, spoon, trowel, grain thief, stainless steel tray	N	None

Notes:

Additional sampling SOPs for high resolution site characterization direct push multilevel groundwater profiling will be submitted once the subcontractor has been identified.

SOP Standard Operating Procedure

QAPP WORKSHEET #22
FIELD EQUIPMENT CALIBRATION, MAINTENANCE, TESTING, AND INSPECTION TABLE

Field Equipment	Calibration Activity¹	Frequency	Acceptance Criteria	Corrective Action	Responsible Person	SOP Reference	Comments
Multiparameter Water Quality Meter ^{1,2}	Oxidation-reduction potential: 2 standard solutions pH: 2 standard solutions Conductivity: 1 standard solution Temperature: no standard solution Turbidity: 2 standard solutions Dissolved oxygen: 2 standard solutions	Daily before first field measurement and after final field measurement	± 10 millivolts ± 0.1 pH unit ± 3% ± 0.1 °C ± 10% ± 10%	Repeat calibration; correct measurements for drift if necessary	Field team leader or field team members	Groundwater Sampling, SOP 010, Revision 4 Groundwater Sample Collection Using Micropurge Technology, SOP 015, Revision No. 0 Field Measurement of Groundwater Indicator Parameters, SOP 061, Revision No. 2	See below ³
PID ²	Gas calibration standard or equivalent	Daily before first field measurement	10% of reading < 2,000 ppm 20% of reading > 2,000 ppm	Repeat calibration; correct measurements for drift if necessary	Field team leader or field team members	Organic Vapor Air Monitoring, SOP 003, Revision No. 2	None

Notes:

ppm Part per million
SOP Standard operating procedure

¹ The field equipment will be calibrated per manufacturer's instructions.

² Standard solutions and calibration gases will be provided by the vendors to calibrate these instruments.

³ SulTRAC will measure water temperature, pH, turbidity, dissolved oxygen, and specific conductance in purged groundwater until these parameters have stabilized within the tolerance identified.

QAPP WORKSHEET #23
ANALYTICAL SOP REFERENCES TABLE

Reference Number	Title, Revision, Date, and/or Number	Definitive or Screening Data	Analytical Group	Instrument	Organization Performing Analysis	Modified for Project Work?
A-1	CLP SOW SOM01.2 for Organics Analysis, Multi-Media, Multi-Concentration	Definitive	VOCs	GC/mass spectroscopy	CLP Laboratory	No
A-4	EPA SW-846 Method 8260	Definitive	VOCs	GC/mass spectroscopy	Subcontractor laboratory	No
A-5	Method TO-15 SIM for Volatile Organics Analysis in Air	Definitive	VOCs	GC/mass spectroscopy	Subcontractor laboratory	No
A-6	Determination of Inorganic Ions in Water by Ion Chromatography (EPA Method 300.0)	Definitive	RP-Water	Ion Chromatograph	TestAmerica, Inc.	No
A-7	Dissolved Gases in Water (EPA Method RSK-175)	Definitive	RP-Water	Gas Chromatograph	TestAmerica, Inc.	No
A-8	Total Organic Carbon (TOC) (SM 5310C)	Definitive	RP-Water	Carbonaceous Analyzer	TestAmerica, Inc.	No
A-9	Alkalinity (SM 2320B)	Definitive	RP-Water	pH Meter	TestAmerica, Inc.	No
A-10	Total Dissolved Solids (SM 2540C)	Definitive	RP-Water	Analytical Balance	TestAmerica, Inc.	No
A-11	Total Organic Carbon (TOC) (EPA SW-846 Method 9060A, modified)	Definitive	RP-Soil	Carbonaceous Analyzer	Subcontractor Laboratory	No
A-12	Particle Size (ASTM Method D422)	Definitive	RP-Soil	Sieves, Hydrometer	Subcontractor Laboratory	No

QAPP WORKSHEET #23 (CONTINUED)
ANALYTICAL INSTRUMENT CALIBRATION TABLE

Reference Number	Title, Revision, Date, and/or Number	Definitive or Screening Data	Analytical Group	Instrument	Organization Performing Analysis	Modified for Project Work?
A-13	Hydraulic Conductivity and Permeability (ASTM Method D5084)	Definitive	RP-Soil	Permeameter	Subcontractor Laboratory	No
A-14	Bulk Density and Porosity (ASTM Method D7263)	Definitive	RP-Soil	Analytical Balance	Subcontractor Laboratory	No
A-15	Ferrous Iron (SM 3500-Fe B)	Definitive	RP-Water	Spectrophotometer	Test America, Inc.	No

Notes:

ASTM American Society for Testing and Materials (now ASTM International)
CLP Contract Laboratory Program
EPA U.S. Environmental Protection Agency
GC Gas Chromatograph
RP Remediation Parameters
SM Standard Methods for the Examination of Water and Wastewater
SOW Statement of work

QAPP WORKSHEET #24
ANALYTICAL INSTRUMENT CALIBRATION TABLE

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action(CA)	Person Responsible for CA	SOP Reference¹
Ion chromatograph	Run 5 calibration standards and a blank	12-hour continuing calibration acceptance criteria	Always, resolution per SOP CF %D<20%	Inspect the system for problems. Clean the system. Verify operating conditions. Take corrective actions to achieve the technical acceptance criteria	Subcontractor laboratory analyst	A-6
Gas Chromatograph	Initial and continuing calibrations per SOP	A CCV will be analyzed after every 10 samples	Always, resolution per SOP CCV recovery 85-115%	Inspect the system for problems and take necessary corrective actions to achieve the acceptance criteria per SOP	Subcontractor laboratory analyst	A-7
Carbonaceous analyzer	Run at least 3 calibration solutions and a blank	Analyze a CCV after every 10 samples or 2 hours, whichever is more frequent	CCV recovery 70-130%	Inspect the system for problems. Clean the system. Verify operating conditions. Take necessary corrective actions to achieve the technical acceptance criteria	Subcontractor laboratory analyst	A-8, A-11
pH Meter	Run daily CCV	Analyze a CCV after every 10 samples or 2 hours, whichever is more frequent	CCV recovery, ± 0.10 pH unit	Inspect the system for problems. Clean the system. Verify operating conditions. Take necessary corrective actions to achieve the technical acceptance criteria	Subcontractor laboratory analyst	A-9
Analytical balance	Check weight in range of objects to be weighed	Daily before and after use	Deviation from nominal weight less than twice the tolerance for the class of weight	Inspect the system for problems. Clean the system. Verify operating conditions. Take necessary corrective actions to achieve the technical acceptance criteria	Subcontractor laboratory analyst	A-10, A-14
Sieves, hydrometer	Inspect for off-size holes, cracks, bent/warped parts, and other defects	Daily before use	Any observable defect	Replace faulty component	Subcontractor laboratory analyst	A-12

QAPP WORKSHEET #24 (CONTINUED)
ANALYTICAL INSTRUMENT CALIBRATION TABLE

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action	Person Responsible for CA	SOP Reference¹
Permeameter	Inspect for pinholes, cracks, and other defects. Check all connections and tubing for leaks	Daily before use	Any observable defect	Replace faulty component	Subcontractor laboratory analyst	A-13
Spectrophotometer	Run at least three calibration standard solutions and a blank	A CCV will be analyzed after every 10 samples or after 2 hours, whichever is more frequent.	Deviation from the initial calibration verification: 70 to 130 percent.	Inspect the system for problems, clean the system, verify operating conditions, and take corrective actions to achieve the technical acceptance criteria.	Subcontractor laboratory analyst	A-15

Notes:

%D Percent difference
CA Corrective action
CCV Continuing calibration verification
CF Calibration factor

¹ See Worksheet #23 for identification of analytical methods.

QAPP WORKSHEET #25
ANALYTICAL INSTRUMENT AND EQUIPMENT MAINTENANCE
TESTING, AND INSPECTION TABLE

Instrument/ Equipment	Maintenance Activity	Inspection Activity	Frequency	Acceptance Criteria	Corrective Action (CA)	Responsible Person	SOP Reference¹
Ion chromatograph	Daily inspection, repair as necessary	Connections, valves/flow rates, and other items specified by instrument manufacturer	Per manufacturer's instructions	See A-6	Inspect the system for problems. Clean the system. Verify operating conditions. Take corrective actions to achieve the technical acceptance criteria.	Subcontractor laboratory analyst	A-6
Gas Chromatograph	Daily check, following manufacturer's instructions	Per manufacturer's instructions	Per manufacturer's instructions	See A-7	Inspect the system for problems. Clean the system. Verify operating conditions. Take corrective actions to achieve the technical acceptance criteria.	Subcontractor laboratory analyst	A-7
Carbonaceous analyzer	Daily check, following manufacturer's instructions	Per manufacturer's instructions	Per manufacturer's instructions	See A-8 and A-11	Inspect the system for problems. Clean the system. Verify operating conditions. Take corrective actions to achieve the technical acceptance criteria.	Subcontractor laboratory analyst	A-8, A-11
pH Meter	Daily check, initial calibration verification	Check connections, cleanliness of electrode, operating temperature, and other items specified in manufacturer's instructions	See A-9	See A-9	Inspect the system for problems. Clean the system. Verify operating conditions. Take corrective actions to achieve the technical acceptance criteria.	Subcontractor laboratory analyst	A-9
Analytical balance	Daily check, annual inspection by trained mechanic.	Cleanliness and functions within tolerances for class of weights over entire range	See A-10 and A-14	See A-10 and A-14	Inspect the system for problems. Clean the system. Verify operating conditions. Take corrective actions to achieve the technical acceptance criteria.	Subcontractor laboratory analyst	A-10, A-14
Sieves, hydrometer	Daily check	Cleanliness, lack of holes, cracks, bent/warped parts, or other mechanical defects	See A-12	See A-12	Replace faulty equipment.	Subcontractor laboratory analyst	A-12
Permeameter	Daily check	Cleanliness, lack of holes, cracks, bent/warped parts, or other mechanical defects	See A-13	See A-13	Replace faulty component or equipment	Subcontractor laboratory analyst	A-13

QAPP WORKSHEET #25 (CONTINUED)
ANALYTICAL INSTRUMENT AND EQUIPMENT MAINTENANCE
TESTING, AND INSPECTION TABLE

Instrument/ Equipment	Maintenance Activity	Inspection Activity	Frequency	Acceptance Criteria	Corrective Action (CA)	Responsible Person	SOP Reference¹
Spectrophotometer (Ferrous Iron)	Daily Check, Initial calibration verification	Connections, valves/flow rates, temperature settings, and other items specified by instrument manufacturer.	See A-15	See A-15	Inspect the system for problems, clean the system, verify operating conditions, and take corrective actions to achieve the technical acceptance criteria.	Subcontractor Laboratory Analyst	A-15

Note:

1 See Worksheet #23 for identification of analytical methods.

QAPP WORKSHEET #26
SAMPLE HANDLING SYSTEM

SAMPLE COLLECTION, PACKAGING, AND SHIPMENT
Sample Collection (Personnel/Organization): Field sampling personnel/SulTRAC
Sample Packaging (Personnel/Organization): Field sampling personnel/SulTRAC
Coordination of Shipment (Personnel/Organization): Field sampling personnel, analytical coordinator/SulTRAC
Type of Shipment/Carrier: Cooler packed with ice and packing material such as bubble wrap/FedEx or other overnight courier; Summa canister samples should be shipped in original packaging as received from the laboratory and do not need to be cooled with ice
SAMPLE RECEIPT AND ANALYSIS
Sample Receipt (Personnel/Organization): Laboratory personnel/CLP laboratory and subcontracted laboratory
Sample Custody and Storage (Personnel/Organization): Laboratory personnel/CLP laboratory and subcontracted laboratory
Sample Preparation (Personnel/Organization): Laboratory personnel/CLP laboratory and subcontracted laboratory
Sample Determinative Analysis (Personnel/Organization): Laboratory personnel/CLP laboratory and subcontracted laboratory
SAMPLE ARCHIVING
Field Sample Storage (No. of days from sample collection): See Worksheet # 27
SAMPLE DISPOSAL
Personnel/Organization: Laboratory personnel/CLP laboratory and subcontracted laboratory
Number of Days from Analysis: To be determined (or in accordance with individual laboratory SOP)

QAPP WORKSHEET #27

SAMPLE CUSTODY REQUIREMENTS

Field Sample Custody Procedures (sample collection, packaging, shipment, and delivery to the laboratory): SulTRAC will use EPA's Field Operations and Records Management System (Scribe) software to manage sample collection, documentation, chain of custody (COC), and reporting for the contract laboratory program (CLP) samples. Field personnel will input data into Scribe and then use the software to generate sample labels, bottle tags, and chain-of-custody forms to track samples from the field to the laboratory.

The CLP Scribe requirements will not apply for groundwater samples that will not be analyzed through the CLP. SulTRAC will use laboratory-provided COC forms for these samples that require the same level of information as the EPA COC forms, with the exception of the CLP-specific information (CLP case number, CLP sample numbers, and sample tag numbers).

COC forms will be signed in ink by the samplers and the individual relinquishing custody. SulTRAC will then follow the sample packaging and shipment procedures summarized below to ensure that samples arrive at the laboratory with the chain of custody intact.

- 1 - Immediately after sample collection, sample containers will be labeled with the appropriate identifiers. Clear tape will be placed over the sample container's labels to prevent smearing.
- 2 - The samples will be placed in Ziploc plastic bags and then in a cooler containing double-sealed bags of ice and maintained at 4 degrees Celsius (°C). The cooler will remain in a secured area or in view of the sampler until it is properly sealed for shipment to the laboratory. (Note: Ice is not required for Summa canister samples).
- 3 - Prior to shipping, the chain-of-custody forms, airbills, and all other relevant documents will be completed. Chain-of-custody forms will be sealed in plastic bags and taped to the inside of the cooler lid. Cushioning material, such as bubble-wrap, will be placed in the cooler.
- 4 - A temperature blank consisting of a jar or vial containing water will be included in every cooler to be used by the laboratory to determine the cooler temperature at the time of sample receipt. (Note: A temperature blank is not required for Summa canister samples).
- 5 - The shipping cooler will then be sealed with tape and custody seals in a manner that will indicate whether the cooler was opened. The preferred procedure includes placement of custody seals at diagonally opposite corners of the cooler. The custody seals will be covered with clear plastic tape or strapping tape.

The field sampler is personally responsible for the care and custody of the samples until they are transferred to other personnel or properly dispatched to an overnight carrier or directly to a laboratory. When transferring possession of the samples, the individuals relinquishing and receiving the samples sign, date, and note the time of transfer on the chain-of-custody form. Commercial carriers are not required to sign off on the chain-of-custody form as long as the form is sealed inside the sample cooler and the custody seals remain intact.

QAPP WORKSHEET #27 (CONTINUED)
SAMPLE CUSTODY REQUIREMENTS

Laboratory Sample Custody Procedures (receipt of samples, archiving, and disposal): The laboratory sample custodian will receive all incoming samples and indicate receipt by signing the accompanying custody forms and retaining copies of the signed forms as permanent records. The laboratory sample custodian will record all pertinent information concerning the sample, including the persons delivering and receiving the sample, the date and time received, the method the sample was transmitted to the laboratory, sample condition at the time of receipt (sealed, unsealed, or broken container; temperature; or other relevant remarks), the sample identification number, and any unique laboratory identification number associated with the sample. This information should be entered into a computerized laboratory information management system (LIMS).

The laboratory will provide a secure storage area, restricted to authorized personnel, for all samples. Only the custodian can distribute samples to laboratory personnel authorized to conduct the required analyses. Laboratory analytical personnel are responsible for the care and custody of the sample upon receipt.

At the completion of sample analysis, any unused portion of the sample, together with all identifying labels, will be returned to the custodian. The returned tagged sample will be retained in secure storage until the custodian receives permission to dispose of the sample. Sample disposal will occur only on the order of the laboratory project manager in consultation with EPA or SulTRAC, or when it is certain that the information is no longer required or the samples have deteriorated. Likewise, laboratory records will be maintained until the information is no longer required and final disposition is ordered by the laboratory project manager in consultation with EPA or SulTRAC.

Sample Identification Procedures: Sample identification will be as described in Section 3.10 of the FSP. Each CLP sample will also be assigned an identifying number by CLP Scribe software. Before or during the sampling event, the user will enter information regarding the site, project, sampling team, analysis, location, matrix (SB – soil boring, SW – surface water, MW – monitoring well), collection time and date, and sample and tag numbers.

When the laboratory receives a sample shipment, its LIMS will generate the in-house identification numbers in accordance with its sample receipt and chain-of-custody standard operating procedures.

QAPP WORKSHEET #28
QC SAMPLES TABLE

Matrix	Water
Analytical Group	RP-Inorganic Anions
Concentration Level	N/A
Sampling SOP	S-5
Analytical Method/ SOP Reference	A-6
Sampler's Name/ Organization	TBD/SulTRAC
Analytical Organization	Subcontracted Laboratory
No. of Sampling Locations	See Worksheet #18

QC Sample	Frequency/ Number	Corrective Action (CA)	Person(s) Responsible for CA	DQI	Measurement Performance Criteria
Method Blank	1 per extraction batch, 20 samples maximum	If sufficient volume is available, extract and reanalyze samples in affected batch. If sufficient volume is not available, reanalyze affected extracts.	Laboratory Analyst	Accuracy/Bias Contamination	No target compounds > QL
Laboratory Control Sample, Laboratory Duplicate	1 per analytical batch, 20 samples maximum	Perform corrective action as needed. If problems continue, recalibrate instrument.	Laboratory Analyst	Accuracy	%R and RPD as presented in Worksheet #12
Matrix Spike	1 per extraction batch, 20 samples maximum	If sufficient volume is available, extract and reanalyze samples in affected batch. Otherwise, analyze laboratory control sample to see if problem is analysis or sample.	Laboratory Analyst	Accuracy and Precision	%R as presented in Worksheet #12

QAPP WORKSHEET #28 (CONTINUED)
QC SAMPLES TABLE

Matrix	Water
Analytical Group	RP-Dissolved gases
Concentration Level	N/A
Sampling SOP	S-5
Analytical Method/ SOP Reference	A-7
Sampler's Name/ Organization	TBD/SuITRAC
Analytical Organization	Subcontracted Laboratory
No. of Sampling Locations	See Worksheet #18

QC Sample	Frequency/ Number	Corrective Action (CA)	Person(s) Responsible for CA	DQI	Measurement Performance Criteria
Method Blank	1 per extraction batch, 20 samples maximum	If sufficient volume is available, extract and reanalyze samples in affected batch. If sufficient volume is not available, reanalyze affected extracts.	Laboratory Analyst	Accuracy/Bias Contamination	No target compounds > QL
Laboratory Control Sample, Laboratory Duplicate	1 per analytical batch, 20 samples maximum	Perform corrective action as needed. If problems continue, recalibrate instrument.	Laboratory Analyst	Accuracy	%R and RPD as presented in Worksheet #12
Matrix Spike/Matrix Spike Duplicate	1 per extraction batch, 20 samples maximum	If sufficient volume is available, extract and reanalyze samples in affected batch. Otherwise, analyze laboratory control sample to see if problem is analysis or sample.	Laboratory Analyst	Accuracy and Precision	%R and RPD as presented in Worksheet #12

QAPP WORKSHEET #28 (CONTINUED)
QC SAMPLES TABLE

Matrix	Water
Analytical Group	RP-TOC
Concentration Level	N/A
Sampling SOP	S-5
Analytical Method/ SOP Reference	A-8
Sampler's Name/ Organization	TBD/SuITRAC
Analytical Organization	Subcontracted Laboratory
No. of Sampling Locations	See Worksheet #18

QC Sample	Frequency/ Number	Corrective Action (CA)	Person(s) Responsible for CA	DQI	Measurement Performance Criteria
Method Blank	1 per extraction batch, 20 samples maximum	If sufficient volume is available, extract and reanalyze samples in affected batch. If sufficient volume is not available, reanalyze affected extracts.	Laboratory Analyst	Accuracy/Bias Contamination	No target compounds > QL
Laboratory Control Sample, Laboratory Duplicate	1 per analytical batch, 20 samples maximum	Perform corrective action as needed. If problems continue, recalibrate instrument.	Laboratory Analyst	Accuracy	%R and RPD as presented in Worksheet #12
Matrix Spike/Matrix Spike Duplicate	1 per extraction batch, 20 samples maximum	If sufficient volume is available, extract and reanalyze samples in affected batch. Otherwise, analyze laboratory control sample to see if problem is analysis or sample.	Laboratory Analyst	Accuracy and Precision	%R and RPD as presented in Worksheet #12

QAPP WORKSHEET #28 (CONTINUED)
QC SAMPLES TABLE

Matrix	Water
Analytical Group	RP-Alkalinity
Concentration Level	N/A
Sampling SOP	S-5
Analytical Method/ SOP Reference	A-9
Sampler's Name/ Organization	TBD/Su/TRAC
Analytical Organization	Subcontracted Laboratory
No. of Sampling Locations	See Worksheet #18

QC Sample	Frequency/ Number	Corrective Action (CA)	Person(s) Responsible for CA	DQI	Measurement Performance Criteria
Method Blank	1 per extraction batch, 20 samples maximum	If sufficient volume is available, extract and reanalyze samples in affected batch. If sufficient volume is not available, reanalyze affected extracts.	Laboratory Analyst	Accuracy/Bias Contamination	No target compounds > QL
Laboratory Control Sample	1 per analytical batch, 20 samples maximum	Perform corrective action as needed. If problems continue, recalibrate instrument.	Laboratory Analyst	Accuracy	%R as presented in Worksheet #12
Laboratory duplicate	1 per extraction batch, 20 samples maximum	If sufficient volume is available, extract and reanalyze samples in affected batch. Otherwise, analyze laboratory control sample to see if problem is analysis or sample.	Laboratory Analyst	Accuracy and Precision	RPD as presented in Worksheet #12

QAPP WORKSHEET #28 (CONTINUED)
QC SAMPLES TABLE

Matrix	Water
Analytical Group	RP-TDS
Concentration Level	N/A
Sampling SOP	S-5
Analytical Method/ SOP Reference	A-10
Sampler's Name/ Organization	TBD/Su/TRAC
Analytical Organization	Subcontracted Laboratory
No. of Sampling Locations	See Worksheet #18

QC Sample	Frequency/ Number	Corrective Action (CA)	Person(s) Responsible for CA	DQI	Measurement Performance Criteria
Method Blank	1 per extraction batch, 20 samples maximum	If sufficient volume is available, reanalyze samples in affected batch.	Laboratory Analyst	Accuracy/Bias Contamination	No target compounds > QL
Laboratory Control Sample	1 per analytical batch, 20 samples maximum	Perform corrective action as needed. If problems continue, recalibrate instrument.	Laboratory Analyst	Accuracy	%R as presented in Worksheet #12
Laboratory Duplicate	1 per extraction batch, 20 samples maximum	If sufficient volume is available, reanalyze samples in affected batch. Otherwise, analyze laboratory control sample to see if problem is analysis or sample.	Laboratory Analyst	Accuracy and Precision	RPD as presented in Worksheet #12

QAPP WORKSHEET #28 (CONTINUED)
QC SAMPLES TABLE

Matrix	Water
Analytical Group	RP-Ferrous Iron
Concentration Level	N/A
Sampling SOP	S-5
Analytical Method/ SOP Reference	A-15
Sampler's Name/ Organization	TBD/SulTRAC
Analytical Organization	Subcontracted Laboratory
No. of Sampling Locations	See Worksheet #18

QC Sample	Frequency/ Number	Corrective Action (CA)	Person(s) Responsible for CA	DQI	Measurement Performance Criteria
Method Blank	1 per analytical batch, 20 samples maximum	If sufficient volume is available, extract and reanalyze samples in affected batch. If sufficient volume is not available, reanalyze affected extracts.	Laboratory Analyst	Accuracy/Bias Contamination	No target compounds > QL
Laboratory Control Sample, Laboratory Duplicate	1 per analytical batch, 20 samples maximum	Perform corrective action as needed. If problems continue, recalibrate instrument.	Laboratory Analyst	Accuracy	%R and RPD as presented in Worksheet #12

QAPP WORKSHEET #28 (CONTINUED)
QC SAMPLES TABLE

Matrix	Soil				
Analytical Group	RP-TOC				
Concentration Level	N/A				
Sampling SOP	S-1				
Analytical Method/ SOP Reference	A-11				
Sampler's Name/ Organization	TBD/SulTRAC				
Analytical Organization	Subcontracted Laboratory				
No. of Sampling Locations	See Worksheet #18				
QC Sample	Frequency/ Number	Corrective Action (CA)	Person(s) Responsible for CA	DQI	Measurement Performance Criteria
Method Blank	1 per extraction batch, 20 samples maximum	If sufficient volume is available, extract and reanalyze samples in affected batch. If sufficient volume is not available, reanalyze affected extracts.	Laboratory Analyst	Accuracy/Bias Contamination	No target compounds > QL
Laboratory Control Sample, Laboratory Duplicate	1 per analytical batch, 20 samples maximum	Perform corrective action as needed. If problems continue, recalibrate instrument.	Laboratory Analyst	Accuracy	%R and RPD as presented in Worksheet #12
Matrix Spike/Matrix Spike Duplicate	1 per extraction batch, 20 samples maximum	If sufficient volume is available, extract and reanalyze samples in affected batch. Otherwise, analyze laboratory control sample to see if problem is analysis or sample.	Laboratory Analyst	Accuracy and Precision	%R and RPD as presented in Worksheet #12

QAPP WORKSHEET #28 (CONTINUED)
QC SAMPLES TABLE

Matrix	Water
Analytical Group	VOCs ¹
Concentration Level	Low concentration
Sampling SOP	S-5, S-6
Analytical Method/ SOP Reference	A-1, A-4
Sampler's Name/ Organization	Guy Montfort/SulTRAC
Analytical Organization	CLP and Subcontracted On- Site Laboratory
No. of Sampling Locations	See Worksheet #18

QC Sample	Frequency/ Number	Corrective Action (CA)	Person(s) Responsible for CA	DQI	Measurement Performance Criteria
Method Blank	1 per extraction batch samples maximum	If sufficient volume is available, extract and reanalyze samples in affected batch. If sufficient volume is not available, reanalyze affected extracts.	Laboratory Analyst	Accuracy/Bias Contamination	No target compounds > QL
Matrix Spike/Matrix Spike Duplicate	1 per extraction batch samples maximum	If sufficient volume is available, extract and reanalyze samples in affected batch. Otherwise, analyze laboratory control sample to see if problem is analysis or sample.	Laboratory Analyst	Accuracy and Precision	%R and RPD as presented in Worksheet #12
Deuterated Monitoring Compounds	All samples	Reanalyze sample. If on reanalysis, the monitoring compound meets criteria, report reanalysis results. If upon reanalysis, the monitoring compound does not meet criteria, the results are reported in the narrative.	Laboratory Analyst	Accuracy	%R as presented in Worksheet 12

QAPP WORKSHEET #28 (CONTINUED)
QC SAMPLES TABLE

Notes:

%R	Percent recovery
CA	Corrective Action
DQI	Data quality indicator
QL	Quantitation limit
RPD	Relative percent difference
TBD	To be determined

- ¹ VOCs in groundwater will be analyzed by CLP and a subcontracted on-site laboratory. An updated VOCs/Water table will be added and submitted once the subcontracted on-site lab has been identified

QAPP WORKSHEET #29
PROJECT DOCUMENTS AND RECORDS TABLE

Document	Where Maintained
Field notes/logbook	Project file (field data), SulTRAC offices
Chain of custody forms	Project file (laboratory data), SulTRAC offices
Laboratory raw data package	EPA for CLP laboratory data; project file for subcontractor laboratory data
Laboratory equipment calibration logs	EPA for CLP laboratory data; project file for subcontractor laboratory data
Validated data	Project file (laboratory data), SulTRAC offices

QAPP WORKSHEET #30
ANALYTICAL SERVICES TABLE

Matrix	Analytical Group	Concentration Level	Sampling Location/ID Number	Analytical SOP	Data Package Turnaround Time	Laboratory/Organization (Name and Address, Contact Person, and Telephone Number)	Backup Laboratory/Organization (Name and Address, Contact Person and Telephone Number)
Soil, Sediment	VOCs	Low concentration	See Field Sampling Plan in Attachment A of this Sampling and Analysis Plan (FSP)	A-1	21 days	CLP laboratory identified by EPA Region 5	CLP laboratory identified by EPA Region 5
Water	VOCs	Low concentration	See FSP	A-1	21 days	CLP laboratory identified by EPA Region 5	CLP laboratory identified by EPA Region 5
Water	VOCs	Low concentration	See FSP	A-4	21 days	Subcontracted laboratory	Subcontracted laboratory
Sub-Slab vapor, indoor and ambient air	VOCs	NA ¹	See FSP	A-3	21 days	Subcontracted laboratory	Subcontracted laboratory
Water (RP)	Inorganic ions Dissolved gases TOC Alkalinity TDS Ferrous iron	NA NA NA NA NA NA	See FSP	A-6 A-7 A-8 A-9 A-10 A-15	21 days 21 days 21 days 21 days 21 days 21 days	TestAmerica, Inc. 4101 Shuffel Street NW North Canton, Ohio 44720 Dan Pittman (330) 497-9396	TestAmerica, Inc. 4101 Shuffel Street NW North Canton, Ohio 44720 Becki Strait (330) 497-9396
Soil (RP)	TOC Particle size Hydraulic conductivity and permeability Bulk density and porosity	NA NA NA NA	See FSP	A-11 A-12 A-13 A-14	21 days 21 days 21 days 21 days	Subcontracted Laboratory	Subcontracted Laboratory

Notes:

CLP Contract Laboratory Program
EPA U.S. Environmental Protection Agency
NA Not applicable
RP Remediation Parameter
TDS Total dissolved solids
TOC Total organic compound
VOC Volatile organic compound

QAPP WORKSHEET #31
PLANNED PROJECT ASSESSMENTS TABLE

Assessment Type	Frequency	Internal or External	Organization Performing Assessment	Person(s) Responsible for Performing Assessment (Title and Organization)	Person(s) Responsible for Responding to Assessment Findings (Title and Organization)	Person(s) Responsible for Identifying and Implementing CAs (Title and Organization)	Person(s) Responsible for Monitoring Effectiveness of CAs (Title and Organization)
No assessments planned	NA	NA	NA	NA	NA	NA	NA

Note:

NA Not applicable

QAPP WORKSHEET #32
ASSESSMENT FINDINGS AND CORRECTIVE ACTION RESPONSES

Assessment Type	Nature of Deficiencies Documentation	Individual(s) Notified of Findings (Name, Title, Organization)	Timeframe of Notification	Nature of CA Response Documentation	Individual(s) Receiving CA Response (Name, Title, Organization)	Timeframe for Response
No assessments planned	NA	NA	NA	NA	NA	NA

Note:

NA Not applicable

QAPP WORKSHEET #33
QA MANAGEMENT REPORTS TABLE

Type of Report	Frequency (daily, weekly, monthly, quarterly, annually, etc.)	Projected Delivery Date(s)	Person(s) Responsible for Report Preparation (Name, Title, Organization)	Report Recipient(s) (Title and Organization)
Data Validation Report	Once for field sampling	60 days after receipt of all analytical results from laboratory (submitted with RI report)	Guy Montfort, SulTRAC, Project Manager	Shari Kolak, WAM, EPA Region 5

Note:

WAM Work assignment manager

QAPP WORKSHEET #34
VERIFICATION (STEP I) PROCESS TABLE

Verification Input	Description	Internal/ External	Responsible for Verification (Name, Organization)
Chain-of-custody forms	Chain-of-custody forms will be reviewed internally upon their completion and verified against the packed sample coolers they represent. The shipper's signature on the chain-of-custody form should be initialed by the reviewer, a copy of the chain-of-custody form should be retained in the project file, and the original and remaining copies should be taped inside the cooler for shipment.	Internal	TBD, SulTRAC
Field notes/ logbook	Field notes will be reviewed internally and placed in the project file. A copy of the field notes will be attached to the final report.	Internal	Guy Montfort, SulTRAC
Laboratory data	All laboratory data packages will be verified internally by the laboratory performing the work for completeness and technical accuracy prior to submittal.	Internal	CLP Laboratory Subcontracted laboratory
	All received data packages will be verified externally in accordance with the data validation procedures specified in Worksheet #35.	External	Chemist, SulTRAC

Notes:

CLP Contract Laboratory Program
TBD To be determined

QAPP WORKSHEET #35
VALIDATION (STEPS IIA AND IIB) PROCESS TABLE

Step Iia/Iib	Validation Input	Description	Responsible for Validation (Name, Organization)¹
Iia	Chain of custody	Examine traceability of samples from sample collection to sample analysis	EPA (DAT), Analytical Coordinator, SulTRAC
Iia	Holding time	Confirm that holding time requirements are met	EPA (DAT), Chemist, SulTRAC
Iia	Instrument calibration	Confirm that instrument calibration requirements are met	EPA (DAT), Chemist, SulTRAC
Iia	Analytical method	Confirm that analytical methods are specified in QAPP	EPA (DAT), Chemist, SulTRAC
Iib	Performance criteria	Confirm that QC samples meet specified performance criteria; document any deviations in data evaluation summary report	EPA (DAT), Chemist, SulTRAC

Note:

- 1 EPA is responsible for conducting computer-aided data review and evaluation (CADRE) of analytical data generated by CLP laboratories and will review data in accordance with CLP National Functional Guidelines (NFG) for data validation. EPA will provide SulTRAC with a summary data review report for data generated by CLP laboratories, and a SulTRAC chemist will review this report. SulTRAC will review geotechnical data generated by the subcontracted laboratory.

QAPP WORKSHEET #36
VALIDATION (STEPS IIA AND IIB) SUMMARY TABLE

Step IIA/IIB	Matrix	Analytical Group	Concentration Level	Validation Criteria	Data Validator (Title and Organization)¹
IIa	Soil/Sediment	VOCs	Low	DAT criteria and NFG	DAT validation (EPA) and review of case narrative by SulTRAC, validation by SulTRAC for data generated by subcontracted laboratories
IIa	Groundwater/Surface Water	VOCs	Low	DAT criteria and NFG	DAT validation (EPA) and review of case narrative by SulTRAC; validation by SulTRAC for data generated by subcontracted laboratories
IIa	Air	VOCs	Low	QAPP and NFG	Data validation by SulTRAC for data generated by subcontracted laboratories

Note:

¹ EPA is responsible for conducting data assessment tool (DAT, which incorporates CADRE) of analytical data generated by CLP laboratories. SulTRAC is responsible for validation of data generated by and subcontracted laboratories. EPA and SulTRAC reviews will be conducted in accordance with CLP NFG for data validation, as modified by the requirements in this QAPP and the method used by the laboratory. EPA will provide SulTRAC with a summary data review report for data generated by CLP laboratories. The SulTRAC analytical coordinator will review this report to verify that project-specific QC criteria have been met.

QAPP WORKSHEET #37 USABILITY ASSESSMENT

Summarize the usability assessment process and all procedures, including interim steps and any statistics, equations, and computer algorithms that will be used: A team of SulTRAC personnel will perform the data usability assessment. SulTRAC's project manager will be responsible for information in the usability assessment. The project manager will also be responsible for assigning work to the individuals who will support the data usability assessment. Note that the data usability assessment will be conducted on validated data. The results of the data usability assessment will be presented in the final project report.

Precision – Results of laboratory duplicates will be presented separately in tabular format. For each duplicate pair, the RPD will be calculated for each analyte whose original and duplicate values are both greater than or equal to the QL. The RPDs will be checked against the measurement performance criteria presented in Worksheet #12. The RPDs exceeding criteria will be identified in the tables. A discussion will follow summarizing the laboratory precision results. Any conclusions about the precision of the analyses will be drawn, and any limitations on the use of the data will be described.

Accuracy/Bias – Results for laboratory method blanks and instrument blanks will be presented separately in tabular format for each analysis. Similarly, the recovery results for spiked analytes in each analysis will be evaluated. The results for each analyte will be checked against the measurement performance criteria presented in Worksheet #12. Results for analytes that exceed criteria will be identified in the tables. A discussion will follow summarizing the laboratory accuracy/bias results. Any conclusions about the accuracy/bias of the analyses based on contamination will be drawn, and any limitations on the use of the data will be described.

Overall Accuracy/Bias – The results will be presented in tabular format to allow comparison of these results to the sample batch where they apply. These results will be compared to the requirements listed in Worksheet #12. A discussion will follow summarizing overall accuracy/bias results. Any conclusions about the overall accuracy/bias of the analyses will be drawn, and any limitations on the use of the data will be described.

Sensitivity – Results for all laboratory-fortified blanks will be evaluated for each analysis. The results for each analyte will be checked against the measurement performance criteria presented in Worksheet #12 and cross-checked against the QLs presented in Worksheet #15. Results for analytes that exceed criteria will be identified. A discussion will follow summarizing the laboratory sensitivity results. Any conclusions about the sensitivity of the analyses will be drawn, and any limitations on the use of the data will be described.

Representativeness – The large numbers of samples collected during the expanded Phase II RI are considered representative of site conditions, as long as completeness criteria in Worksheet 12 are met.

Comparability – The results of this study will be used as a benchmark for determining comparability for data collected during any potential future sampling events using the same or similar sampling and analytical SOPs. In addition, the results will be compared with data collected during Phases I and II of the RI.

QAPP WORKSHEET #37 USABILITY ASSESSMENT

Completeness – A completeness check will be performed on all data generated by the laboratory. Completeness criteria are presented in Worksheet #12. Completeness will be calculated for each analyte as follows. Completeness will be calculated for each analyte as the number of data points for each analyte and individual matrix that meet the measurement performance criteria for precision, accuracy/bias, and sensitivity, divided by the total number of data points for each analyte. A discussion will follow summarizing the calculation of data completeness. This discussion will also note the differences, if any, between the planned sample collection (number and location) and the actual sample collection. Any conclusions about the completeness of the data for each analyte will be drawn, and any limitations on the use of the data will be described.

Describe the evaluative procedures used to assess overall measurement error associated with the project: NA

Identify the personnel responsible for performing the usability assessment: SulTRAC's analytical coordinator will review analytical data and the CADRE data review report and data validation results for subcontracted laboratories to assess usability of the data. SulTRAC's project manager will review QC results for samples and assess the overall usability of the data set in close consultation with the EPA WAM.

Describe the documentation that will be generated during usability assessment and how usability assessment results will be presented so that they identify trends, relationships (correlations), and anomalies: The usability assessment will be documented in the final data validation report, which will be submitted with the RI report 60 days after the last analytical results are received from the laboratories.

Notes:

CADRE	Computer-aided data review and evaluation
EPA	U.S. Environmental Protection Agency
NA	Not applicable
QC	Quality control
QL	Quantitation limit
RI	Remedial investigation
RPD	Relative percent difference
SOP	Standard operating procedure
WAM	Work assignment manager

REFERENCES

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- EPA. 2013. U.S. EPA Regional Screening Levels for Chemical Contaminants at Superfund Sites. June.